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CANADIAN MACHINERY

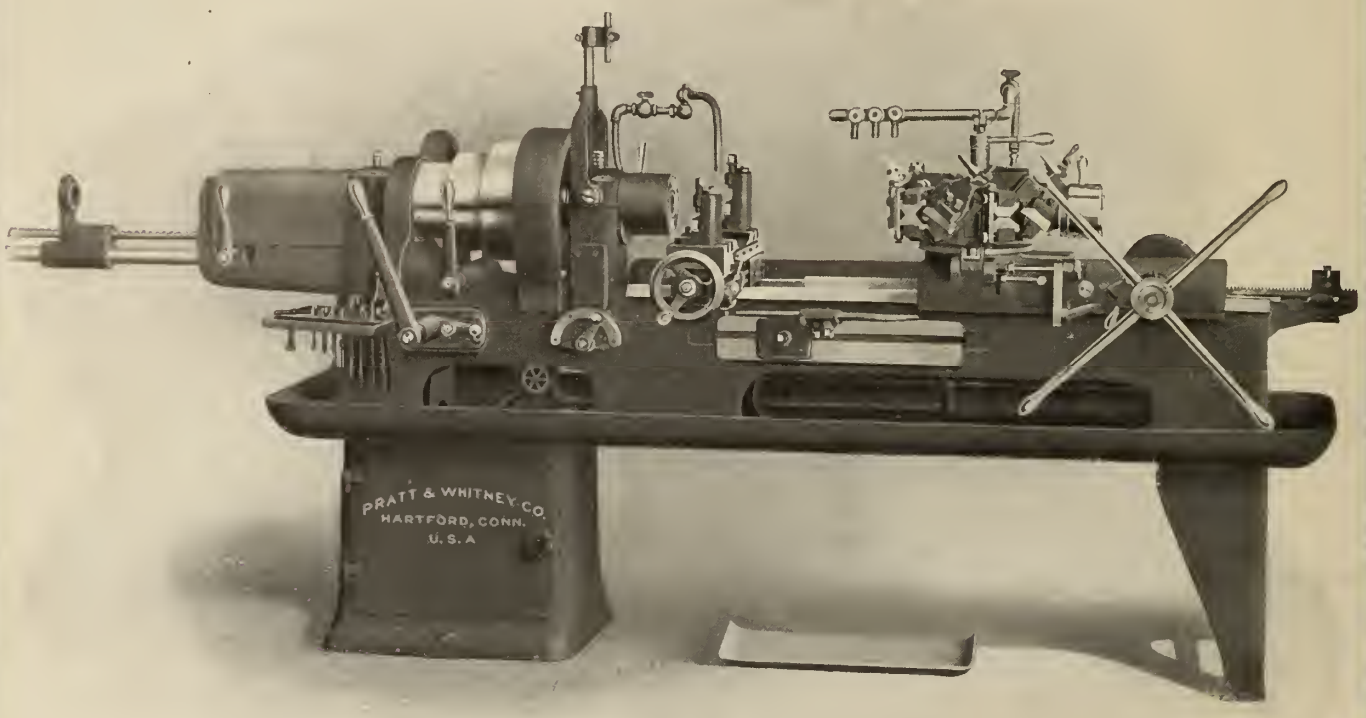
AND MANUFACTURING NEWS

JANUARY
1906

TURRET LATHES

BUILT IN FIVE SIZES:

$\frac{5}{8}$ x $4\frac{1}{2}$, 1 x 10, $1\frac{1}{2}$ x 18, 2 x 26, 3 x 36.



2 x 26 inch Turret Lathe for rod work up to 2 inches diameter and 26 inches long

ON BAR WORK FROM $\frac{1}{2}$ to 2 INCHES DIAMETER THIS MACHINE WILL DO THE WORK OF FROM 3 to 6 ENGINE LATHES. The double cross-slide which is used on all sizes of these machines enables forming and cutting off to be done at the same time the turret tools are at work. The turret stops, one for each tool in the turret, are easy to adjust and simple in construction. These machines may also be used to advantage on chucking work.

Pratt & Whitney Co.

WORKS : HARTFORD, CONN., U.S.A. 111 BROADWAY, NEW YORK

THE CANADIAN FAIRBANKS CO., Agents for Canada.

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Perfection in High Speed Engine Design. Noiseless Running—Perfect Lubrication—Accessibility—Economy

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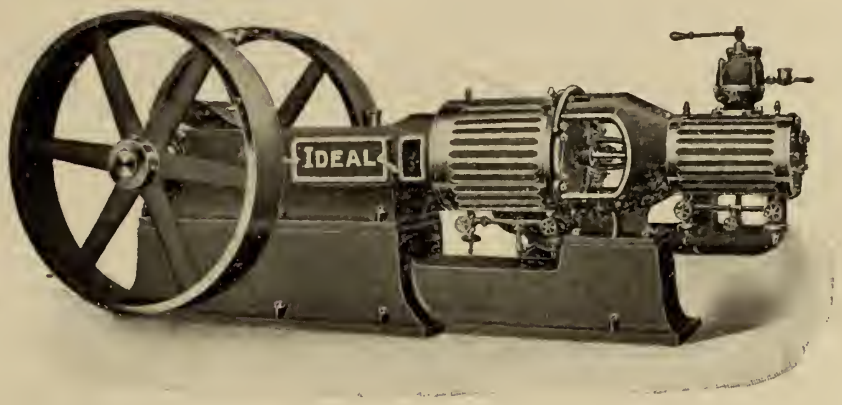

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WE MAKE Wheelock Engines, Corliss Engines, Ideal High Speed Engines, Boilers, Pumps, Flour Mill Machinery, Oatmeal Mill Machinery, Wolf Gyrators, Emery Choppers, Woodworking Machinery, Shingle Machinery, Heading and Stave Machinery, Wood Rim Split Pulleys, Iron Pulleys, Shafting, Hangers, Friction Clutch Couplings, Friction Clutch Pulleys, Safes, Vaults, Vault Doors.

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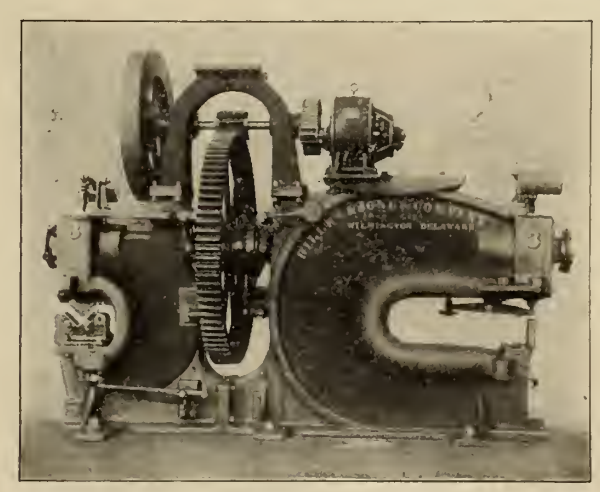
Increase Production—Decrease Costs

Individually driven tools can be used independently of the rest of the shop equipment, and require only the power necessary to operate the driving motor.



Individually driven tools solve all the various problems of the shop lay-out; they can be placed where most convenient to the work required.

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falling over 60 times from a height of 30 feet.
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12"
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TRAMWAY POINTS and CROSSINGS

Tramway Passing Places, Junctions, Depot Sidings, Lay Outs.

Supplied complete with all Fittings ready for laying on the road.

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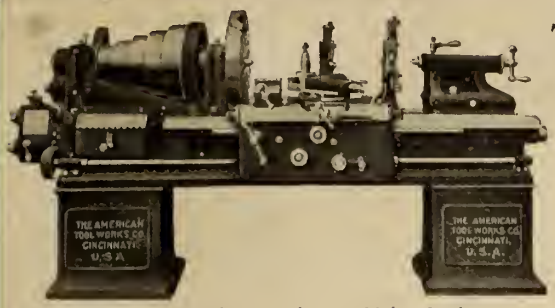

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THE AMERICAN TOOL WORKS CO.
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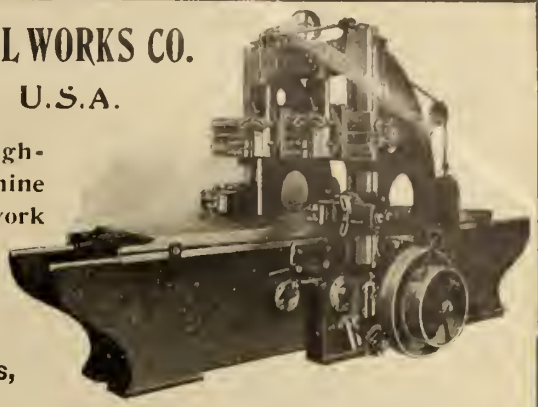
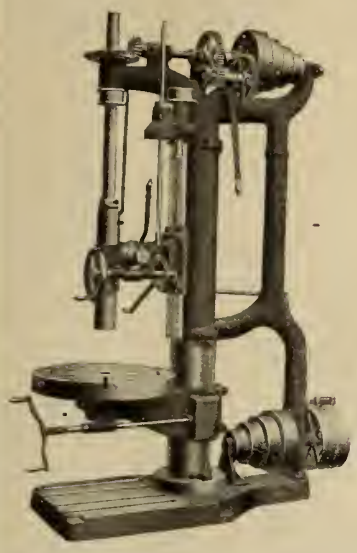
Builders of Modern High-Standard Machine Tools for rapid work production.

Belt or motor driven.

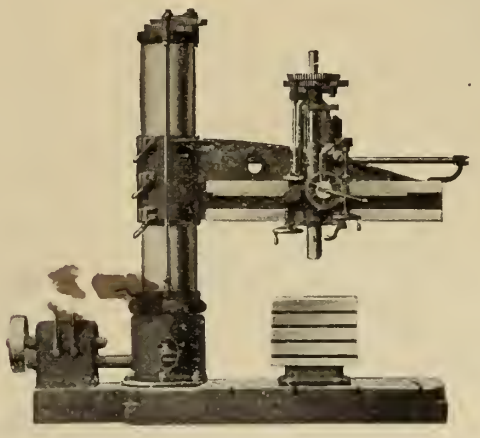


Planers, 22-in. to 72-in. between Housings.

Write direct for catalog, prices, or any desired information.



Upright Drills, 13-in. to 42-in. Swing.

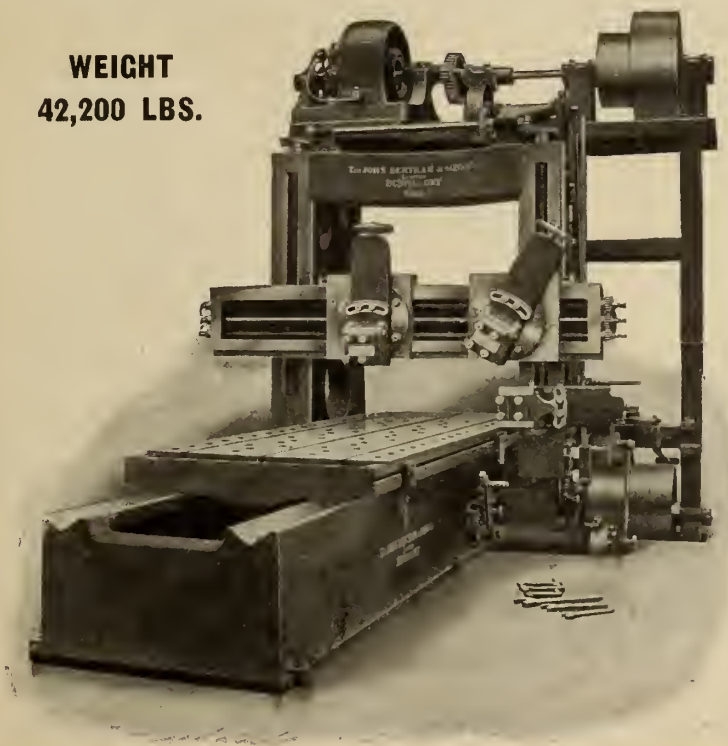


Radial Drills, 2½-ft. to 7-ft. Arms.

Shapers, 16-in. to 28-in. Stroke.

BERTRAM 48-INCH MOTOR-DRIVEN PLANER

WEIGHT 42,200 LBS.



With a solidity afforded by 42,200 lbs. of well-placed metal, with drive gear, rack and pulleys throughout made of steel, this machine is built to withstand the heaviest and the fastest cuts made possible by modern high-speed steel.

The planer shown is of the most approved design. It has motor drive and three cutting heads. Side heads have power feed and are counterbalanced. Write for photograph and full description to

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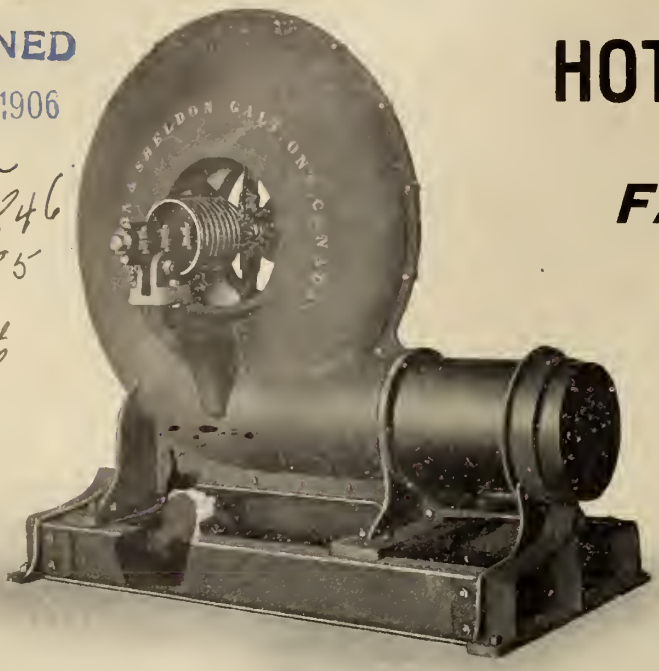

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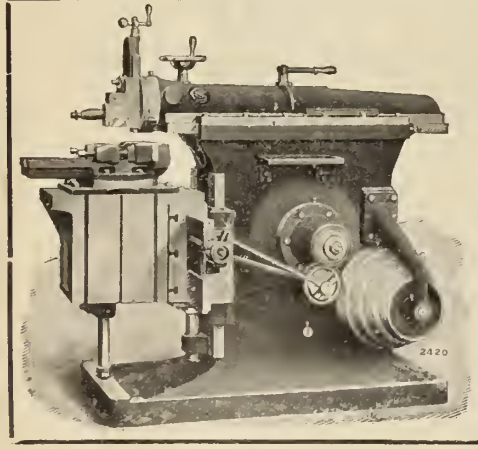

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Are built to stand the excessive strains caused by heavy cuts and big feeds with high-speed steels. All sliding bearings have taper gibs, adjustable endwise by single screws, and the crank block is drop forged. A high-gear ratio, an ample amount of cast-iron properly distributed, and high-class workmanship, combine to place the "CINCINNATI" in the front rank. Catalog on request.

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Wire Screens for every class of material.

Perforated Metal of Steel, Copper, Brass, Zinc for all purposes.

Special attention given to miners' requirements.

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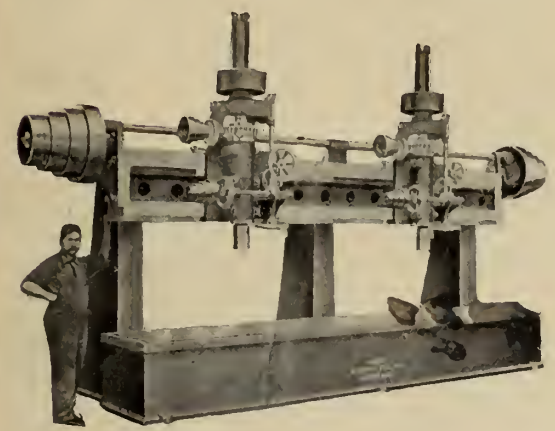
Can equip our Machines for Motor Drive.



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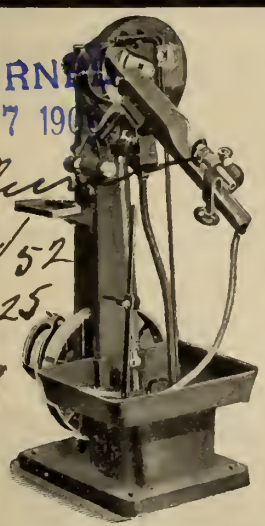

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NEW YANKEE DRILL GRINDERS

These are built in several different sizes and styles. In fact, we make such a variety of machines for grinding all sizes and kinds of drills that we can furnish a machine to suit the conditions peculiar to **YOUR** as well as **ANY OTHER** shop.

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PATTERN MAKING

By Good Workmen
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Also

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Also Manufacturers of

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A COMBINATION OF
POWER, RIGIDITY AND
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Fuel Cost $8.00 per H. P. per Year.

Six of our plants in operation or under erection in Canada.

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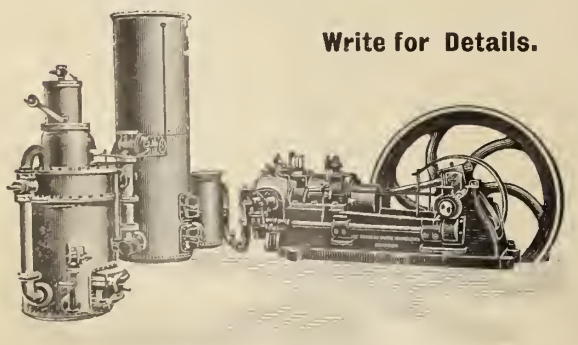

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Is the Leader in

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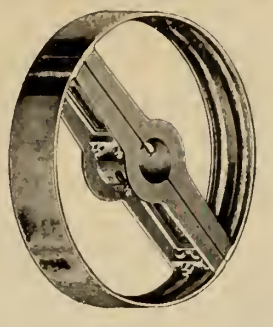
HERE IS A DRILL CHUCK:

WITHOUT JAWS, NO CLUMSY SCREWS,
NO SCROLLS, NO WRENCHES.



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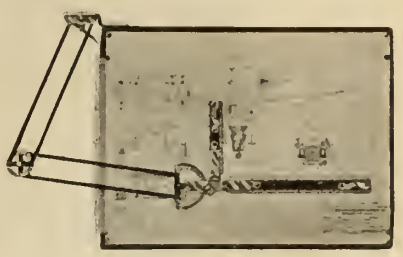

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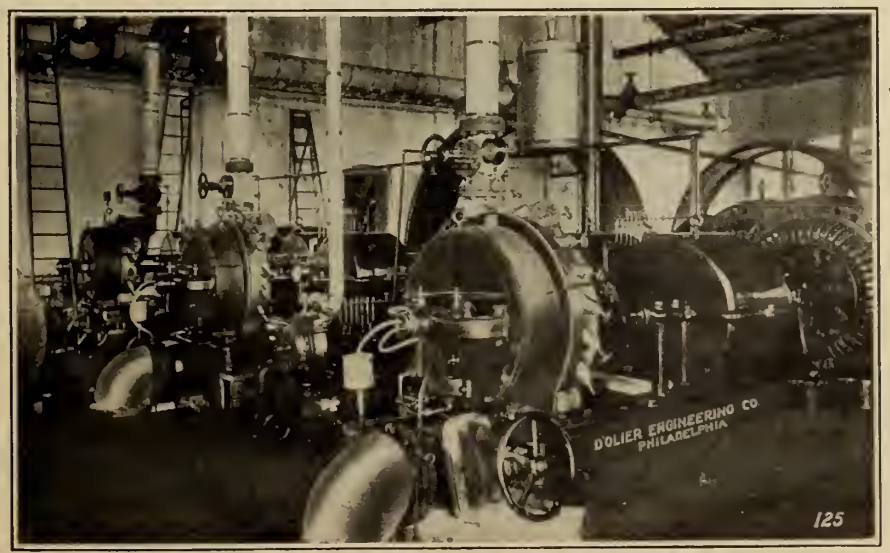
LOCAL OR LONG DISTANCE PHONE, 65 DUNDAS.



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Turbine Motors
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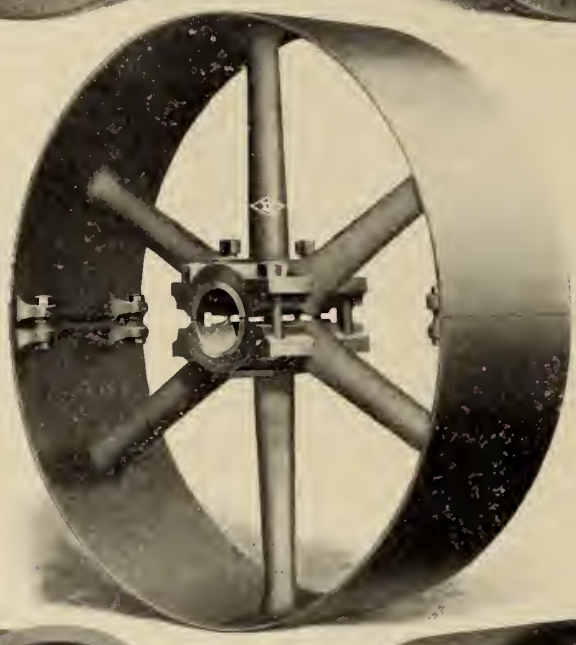

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WE MANUFACTURE A COMPLETE LINE OF POWER TRANSMISSION MACHINERY

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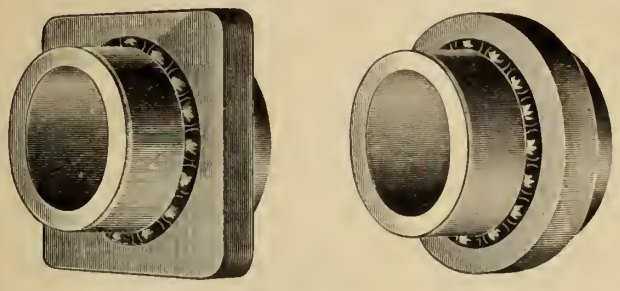

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Strong, Simple, Reliable and Easy-Running.

Can be made any size or shape, and are applicable to every place where a shaft turns in a bearing.

Write for further particulars to the

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Merrell Motor and Engine Driven Machines

Motor Drive

These machines have our standard adjustable quick-opening and closing die heads and our improved cutting-off knife. The chasers are five in number for No. 5½ and No. 6½ machines, and six in number for No. 9½ machine, and eight in number for No. 11½ machine. They are set by graduation to any size desired, are released from threading while in motion and opened to permit of pipe being cut off and closed instantly and positively. These machines will do far more rapid work, both in threading and cutting off, than any other combined machine on the market.

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During 1895-96 a series of experiments were conducted by Prof. C. H. Benjamin, of Cleveland, Ohio, to determine the ratio of the power required to drive shafting and belts, to the total power consumed, in 12 manufacturing plants on both light and heavy work. The results were as follows:

TABLES

Manufacturing Plant Number	Total Horse-Power	Horse-Power to Drive Shafting	Per Cent. to Drive Shafting	Manufacturing Plant Number	Total Horse-Power	Horse-Power to Drive Shafting	Per Cent. to Drive Shafting
1	400	157	39.2	7	40.4	20.7	51.2
2	74	57	77	8	74.3	40	53.8
3	38.6	25.3	65.6	9	47.2	24.5	51.8
4	59.2	47.9	80.7	10	190	108	56.9
5	112	64	57	11	107	74.5	69.7
6	168	91	54.2	12	241	114	47.3
Average, heavy machine work	....	.....	62.3	Average, light machine work	.....	.....	55.1

75 per cent. saving is what we guarantee on shaft friction.

Over 200 of the leading Canadian factories are equipped with Chapman Double Ball Bearings.

Send for catalogues and letters from manufacturers who have them in use.

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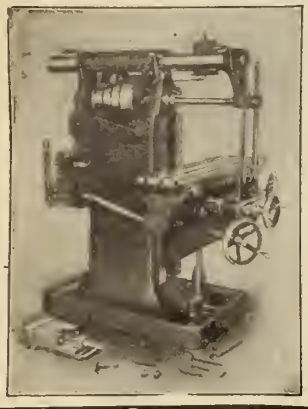
Becker-Brainard Milling Machine Co.

OF

HYDE PARK, MASS.
U. S. A.

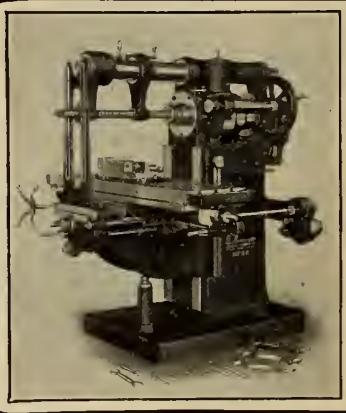


No. 3

When you see that name you know that it represents all that is desirable and necessary for the make up of a practical, durable, money-saving and money-making milling machine.

It is the real merit of our products that has built up the largest milling machine business in the world.
have an attractive catalog which will give you the details in regard to dimensions, etc.

WRITE FOR IT. DON'T PUT IT OFF.



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NAGLE ENGINES

Corliss, High Speed and Slide Valve
5 to 300 H.P.

Lathes,
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Drills,
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in sizes from 4 inches to 24 inches. Price lists and discounts on application

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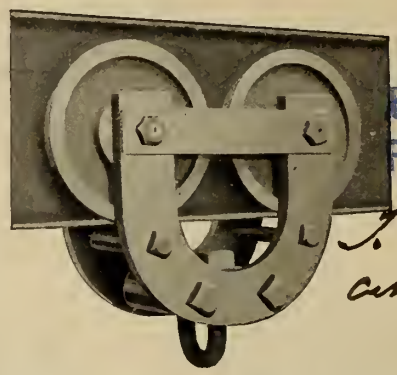

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Cut represents one of our plain yoke trolleys, for suspending Air Hoists or Chain Blocks, for the convenient handling of materials.

Frames of forged steel. Extra large wheels, and steel roller bearings.

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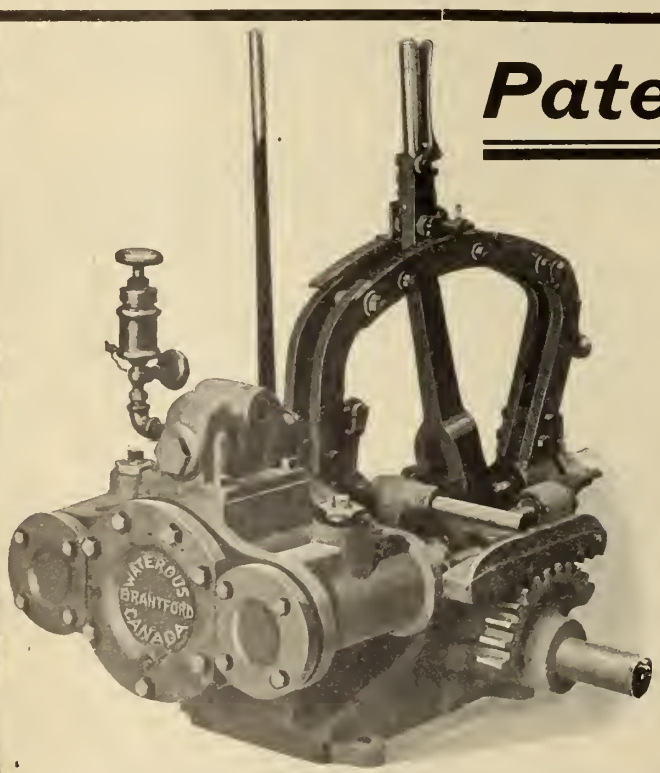

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Very Simple
Easily Attached
Very Reliable

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"The Steam Setter which you sold us for this season's cut has satisfied us beyond our highest expectations. After using it for more than six months we are convinced that it has considerably increased our cut of lumber and has more than twice earned what it cost."

Write us for full particulars and price.

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NEW AND SECOND HAND MACHINERY

Horizontal Boilers

66″ x 14′ almost new.
60″ x 17′ 6″ with 54 4″ tubes.
6″ x 13′ 7″ “ 84 3″ “
56″ x 14′ 4″ “ 64 3″ “
60″ x 12′ “ 82 3″ “ NEW.
56″ x 12′ “ 62 3″ “
48″ x 16′ “ 33 4″ “
48″ x 13′ 6″ “ 52 3″ “
48″ x 13′ 6″ “ 42 3″ “
44″ x 13′ 6″ “ 43 3″ “
44″ x 14′ 6″ “ 40 3″ “
44″ x 11′ 9″ “ 42 3″ “
40″ x 12′ “ 21 3″ “
38″ x 12′ “ 36 3″ “
32″ x 11′ “ 22 3″ “

Upright Boilers

48″ x 10′ 6″ with 152 2″ tubes.
36″ x 72″ “ 60 2″ “
26″ x 60″ “ 37 2″ “
24″ x 48″ “ 31 2″ “
24″ x 5′ “ 31 2″ “
20″ x 40″ “ 41 2″ “
20″ x 36″ “ 16 2″ “ NEW.
19″ x 44″ “ 13 2″ “ NEW.
19″ x 40″ “ 9 2″ “ NEW.

Automatic Engines

16″ x 36″ NEW Laurie Corliss.
15″ x 34″ Left hand Wheelock.
13″ x 30″ Right hand Corliss.
13″ x 30″ Left Hand Wheelock.
11″ x 24″ “ “ Corliss.
10″ x 24″ Right hand Corliss.
12″ x 10″ Westinghouse Junor.
12″ and 20″ x 12″ Erie Ball Tandem compound.
11″ and 19″ x 15″ McIutosh & Seymour Tandem compound.
10″ x 15″ NEW No. 8 Jewel.
8″ x 10″ “ 5 “
8″ and 13″ x 18″ Tandem compound.
6½″ x 8″ Armington & Sims.
5″ x 7″ “ “

Other Steam Engines

Complete generating plant, consisting of 2 17″ x 38″ Wheelock Engines; 2 73″ x 14′ Goldie & McCulloch Boilers; 2 8″ x 12″ x 12″ Condensers, Pumps, Heaters, etc. Also 2 100 K.W., M.P. 4 Generators, Canadian General Electric Co. make. This plant was last used to run an Electric Railway line of 10 cars.
12″ x 12″ Laurie, NEW, horizontal.
9″ x 10″ Leonard C.C.
8¾″ x 9″ horizontal.
8″ x 8″ Laurie, NEW, horizontal.
7″ x 12″ horizontal.
7½″ x 9″ Dutton, NEW, horizontal.
7″ x 7″ NEW, upright.
6″ x 9″ horizontal.
6″ x 7½″ “ centre crank.
6″ x 8″ upright.
6″ x 6″ “ NEW.
5″ x 6″ horizontal.
5″ x 7½″ upright, centre crank.
Also several small engines down to ¾ h.p., horizontal and upright.

Marine Engines

8″ and 16″ x 12″ NEW, fore and aft.
7″ and 14″ x 10″ “ “ “
7½″ and 14″ x 12″ steeple compound.
9″ x 12″ Doty.
9″ x 12″ NEW, complete.
7½″ x 8″ “ Dutton.
6″ x 6″ all complete.
5″ x 7½″ “ “
Also several smaller ones.

Miscellaneous Engines and Boilers

48″ x 9″ Upright Sub. Tube Boiler.
30″ x 84″ “ “ “
36 H. P. Horizontal Self-Cont. Boiler.
8 H. P. “ “ “
25 H. P. Fire Box Boiler.
16 H. P. Waterous Portable Boiler.
7″ x 10″ Cornell “ “
74″ x 11″ Clyde Boiler.
48″ x 72″ Fitzgibbon Boiler.
4 H. P. Acme Engine and Boiler.

Gas or Gasoline Engines

One 50 H. P. New Ohio.
One 21 H. P. New Ohio.
One 15 H. P. Pierce.
Two 14 H. P. New Ohio
One 14 H. P. Ohio on wheels.
One 12 H. P. Brantford.
Two 10 H. P. Haggas.
Three 8 H. P. Ohio, NEW.
One 7 H. P. Triton-Marine.
Two 6 H. P. Ohio.
One 6 H. P. Toronto Junction.
One 5 H. P. New Adams Marine.
Four 4 H. P. New Ohio.
One 3½ H. P. Triton-Marine.
Two 3 H. P. Upright.
One 2½ H. P. New Brantford.
One 2½ H. P. Goldie & McCulloch.
Four 1½ H. P. NEW and Second Hand.

Pumps

1 12″ x 7″ x 12″ Northy Duplex.
3 8″ x 5″ x 12″ NEW Duplex.
5 6″ x 4″ x 7″ “ “
6 5½″ x 3½″ x 6″ “ “
18 4½″ x 2½″ x 4″ “ “
8 3″ x 2″ x 3″ “ “
8″ x 5″ x 12″ Single Acting.
7″ x 4″ x 6″ “ “
6½″ x 4½″ x 7″ “ “
6″ x 4″ x 6″ “ “
5″ x 3½″ x 7″ “ “
Several Small “ “
NEW Morris Centrifugal, Nos. 2 and 4.
NEW Taher Rotary Nos. 0, 1 and 2.
3½″ x 8″ pedestal plunger pump.
3″ x 5″ “ “ “
2″ x 6″ “ “ “
Several small plunger pumps.

Steam Appliances

NEW Pulsometers Nos. 4 to 7.
8 Steam Traps, all sizes.
150 h.p., Goldie, McC. Heater.
150 “ NEW Laurie Heater.
50 “ “ “ “
30 “ “ “ “
40 “ “ Patterson “
30″ x 96″ Heater.
16″ x 50″ “
18″ x 39″ “

Engine Lathes

1 NEW 32″ x 20′ London.
1 “ 32″ x 18′ “
1 30″ x 14″ Heavy bed.
1 NEW 28″ x 18′ London.
1 28″ x 18′ Dundas.
1 NEW 26″ x 16′, also 10′ bed.
5 new 25″, 10′, 12′ and 14′ bed.
8 “ 24″ from 10′ to 20 ft.
4 new 21″, 8′, 14′ and 12′ bed.
10 “ 18″ “ 6′ to 16 ft.
1 24″ x 8′ Dundas.
1 18″ x 6′ in good order.
11 NEW 16″ from 6′ to 10 ft.
2 16″ x 6′ rebuilt.
10 NEW 15″ from 6′ to 10 ft.
4 “ 14″ 6 and 8 ft.
3 “ 13″ 6 “ 8 “
1 14″ x 6′ Dundas.
3 NEW 12″ x 6 ft.
1 “ 11″ x 60″ Barnes.
1 “ 9″ x 57″ “

Cap and other Lathes

NEW 26″ x 42″ x 14′ Gap.
“ 24″ x 40″ x 12′ “
“ 30″ x 46″ x 12′ “
“ 18″ x 32″ x 12′ “
12″ x 24″ x 60″ Dundas.
22″ x 8′ Chucking Lathe.
18″ x 8′ Davis Turrett Lathe.
16″ x 6′ Fox Lathe.
NEW 15″ x 6′ Fox Lathe.
11″ x 48′ Speed Lathe.
NEW 11″ x 72″ Barnes Foot Power.
“ 11″ x 60″ “ “ “
2 “ 9″ x 45″ “ “ “
No. 4½ Barnes “ “
9′ x 40″ Cincinnati “ “

Iron Shapers

2 NEW 24″ Back Geared Imperial.
6 “ 20″ “ “
1 “ 16″ “ “ Cincinnati.
1 “ 16″ Single Geared “
1 10″ second-hand Ohio.
1 “ 7″ Rhodes.

Iron Planers

42″ x 42″ x 20′ Putman.
NEW 36″ x 48″ x 12′ London.
“ 36″ x 44½″ x 10′ London.
“ 26″ x 26″ x 8′ Imperial.
4 “ 24″ x 24″ x 6½′ Imperial
5 “ 20″ x 20″ x 5′ London.
24″ x 24″ x 36″ American.
23″ x 20″ x 5½′ American.
3 Small Hand Planers.

Drilling Machines

3 NEW 100′ Plain Radials.
2 “ 72″ Universal Radials.
1 6 Spindle Multiple.
1 4 “ “
2 NEW 31″ Barnes.
1 “ 28″ “
1 “ 24″ Cincinnati, with tapping attachment.
1 NEW 24″ London.
1 24″ in good shape.
7 NEW 20″ Barnes, B. G.
3 “ 20″ “ Lever Feed.
2 “ 14″ Sensitive, Pedestal.
2 “ 14″ “ Bench.
2 11″ Plain, Upright.
1 NEW 12″ Barnes Friction.
2 “ 12″ Friction.
1 “ Fox High Speed Drill
6 Sensitive Bench Drills, NEW.
2 Post or Wall Drills.
8 Blacksmiths' Hand Drills.
6 “ “ and Power Drills.

Presses and Hammers

1 No. 45 Power Press, NEW.
5 “ 21 “ “ “
4 “ 20 “ “ “
3 No. 18 Power Press, new.
6 “ 19 “ “ “
1 “ 16 “ “ “
No. 2 Cady Press.
Heavy Bliss Stamping Press.
NEW No. 1, Challenge Soap Press.
Power Draw Press.
NEW Erie 400 lb. Steam Hammer.
“ 150 lb. Drop Hammer.
2 “ 150 lb Law Power Hammers.
60 lb. Palmer Spring “
NEW 50 lb. Foot Power “
4¾″ x 10″ Steam Hammer.
Several smaller ones.

Punches and Shears

1 NEW 20″ throat, London.
5 “ 15″ “ “
14″ throat, Bertram make.
NEW No. 5, Bremer, Single,
“ “ 4, “ Double.
“ “ 2, “ Single.
“ “ 1, “ “
“ “ 1, “ Double.
Large Power Alligator Shear.

Other Machine Tools

NEW No. 1, Cincinnati Plain Miller.
30″ x 6″ x 16″, Stevens Un. “
6 NEW Power Hack Saws.
5 Iron Frame Keyseaters.
NEW 2″ Cutting-off Machine.
“ Centreing Machine.
Large Hand Screw Press.
2″ Bolt Cutter and Threader.
NEW 1¼″ National Bolt Cutter.
“ 1″ Acme “ “
“ 2″ “ “ “
4″, Curtis Pipe Machine.
Several Bench and Pedestal Emery Grinders—all sizes.
2 NEW 2½ Ton Portable Cranes.
Crab Winches—all sizes.

Wood Planers

30″ Heavy Smoothing Planer.
27″ Cowan Double Surfacer
26″ Me. G. G. “ “
24″ “ “ “
NEW 24″ x 9″ Surface Planer.
24″ Surface Planer, rebuilt.
24″ Pony “ “
22″ Surface “ “
NEW 16″ x 9″ Surface Planer
“ 12″ Pony Planer.
“ 24″ “Handy” Planer and Matcher
24″ rebuilt “ “ “
24″ Double Surfacer and Matcher.
NEW 13″ x 7″ Lightning Planer and Matcher.
13″ Fast-feed Flooring Machine.

Buzz Planers

3 NEW 12″ Pedestal.
1 12″ rebuilt.
1 10″ “
1 6″ “
58″ Stroke Jointer

Wood Moulders

8″ 3 Side Cowan.
7″ 3 “ all rebuilt.
6″ 3 “ Cant. Gourlay
6″ Sash Sticker.

Saw Tables

NEW No. 18 Combination.
2 “ “ 1 Clement, Variety
4 “ Variety Tables.
Dimension Saw Table.
No. 3. S. F. Rip Saw, Ballantyne.
Egan Double Cut-off Saw.
NEW Champion Cut-off Saw.
Cowan Railway “ “
4 Wood Frame Machines.
2 NEW Swing Saws.
2 Rebuilt “ “

Band Saws

2 NEW 36″ Pedestal.
36″ Pedestal in good order
NEW 32″ Pedestal.
“ 30″ Bracket.
30″ Bracket, rebuilt
NEW 26″ Pedestal.

Re-Saws

Rebuilt Band Re-Saw, 54″.
40″ Galt Circular Re-Saw.
36″ “ “ “
Rogers Vertical “

Other Wood-Working Machines

2 NEW Heavy Shapers.
3 Rebuilt Shapers.
Galt Power Mortiser.
NEW Foot Power Mortiser.
Rebuilt “ “
4 Tenoning Machines.
2 Dowel Machines, 1¼″ and 2½″.
3 Dovetailing Machines.
36″ Double Drum Egan Sander
3 Box-Nailing Machines.
7 Blind Slat Tenoners.
Borers and Wirers.
NEW Lath Mill 4 saws.
Waymouth Guage Lathe.
18″ Wood Lathe.
Wood Trimmers, all sizes.
3 Self-acting Shingle Machines.
Swing Shingle Machines.
Shingle Jointers and Packers.

Saw Mill Machinery

2 NEW 3 Block Mills.
3 Rebuilt Mills.
NEW No. 4 Tower Double Edger.
“ Tower Trimmer.
No. 1 Gang Edger 3 16″ Saws.
NEW Wood Frame Drag Saw.

Water Wheels

23″ Right Hand Leffel.
25″ “ “ Farrens.
26″ Left “ Leffel
30″ “ “ Perfection.
Water Wheel Governor.

New Cocoa and Chocolate Machinery

One extra sized Milanger.
One 6 roll Refiner.
One Patent Continuous Refiner.
One Triple Mill.
One Gas Roaster, capacity 200 lbs.
One Cocoa Sorting and Cleaning Machine.
One Patent Hydraulic Cocoa Press.
One No. 2 Sifter for cocoa powder.

Also the following:

Electric Motors and Dynamos.
Blowers and Exhausters.
Printers' Machinery.
Laundry Machinery.
Tinsmiths' Tools.
Grist Mill Machinery.
Contractors' Machinery.

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Prices and details cheerfully given for the asking. Ask for a copy of my latest monthly Stock List.

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Steam and Power Pumps, Condenser and Travelling Crane, Etc.

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COLD DIE-ROLLED STEEL and IRON

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ROUNDS, SQUARES, FLATS, HEXAGONS and SPECIAL SHAPES

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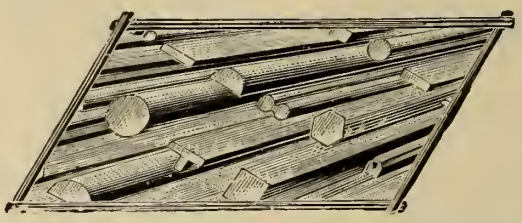

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TURRET PUNCH

(Patent Applied for)

Easily Operated. Durable. Will punch holes 1-8 to 1-2 inch in heavy band and sheet iron, 2½ in. from edge of sheet. Only machine of its kind on the market. Endorsed wherever used.

WRITE AT ONCE FOR PARTICULARS.

TAYLOR & McKENZIE

General Machine Shop. Guelph, Ont.

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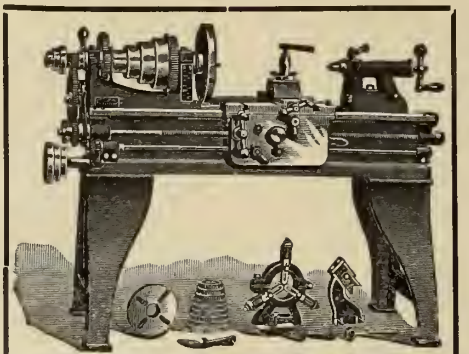

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in buying a lathe is to get one suited to your requirements. You can't do better than try a

Sebastian Lathe

It is strong, substantial, fitted with all the latest improvements and admirably adapted for turning out all work within its capacity with the greatest degree of accuracy and economy. Sizes, 9 to 15 inch swing.

Catalogue for full description

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128-130 Culvert Street,

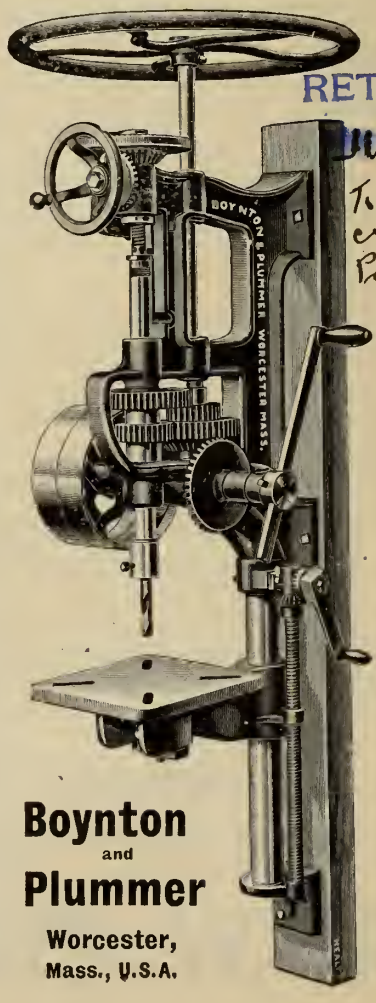
CINCINNATI, OHIO, U.S.A.

CANADIAN AGENTS

H. W. Petrie, Toronto.

Canada Machinery Agency, Montreal.

We show in this cut our No. 3 improved upright self-feeding drill. The cut gears of this tool are so arranged that a quick or slow motion may be given the drill for light or heavy work.



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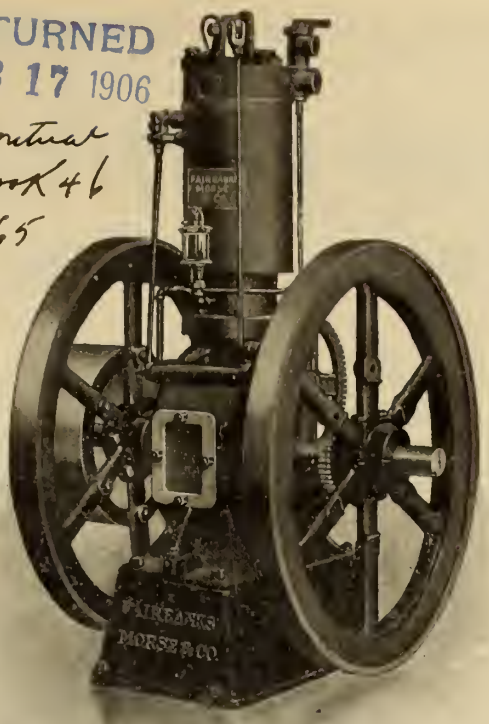

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We don't know, but we know what you should use.

GAS OR GASOLINE, DISTILLATE, KEROSENE OR CRUDE OIL

Why?

Because these are **the** powers of to-day.

Figure it out.

If you have a steam plant you have to keep fire going nearly all the time.

You need one or more men constantly in charge. Your coal keeps on burning whether the engine is running or not.

We could mention more, but won't now.

Take a Fairbanks-Morse Gas or Gasoline Engine.

When you are ready for power you start it, and it only takes a moment.

You can shut it down just as quickly.

Fuel consumed is only in proportion to the load on the engine.

It requires no attention after being started, until you want to shut it down.

Did you ever take the trouble to enquire into the merits of this form of power, and see how totally different Fairbanks-Morse Gas and Gasoline engines are from other makes?

THE CANADIAN FAIRBANKS COMPANY, Limited.

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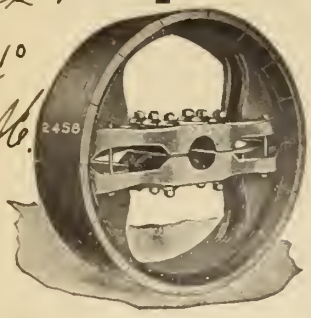
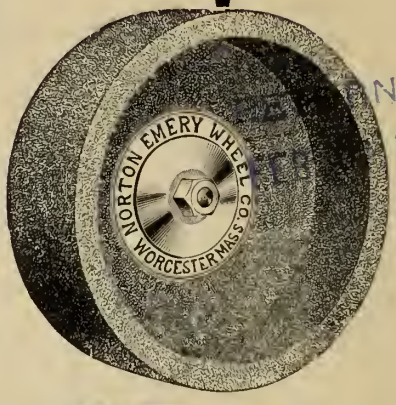
A Machine Shop Uses

We Sell





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Universal Giant Hangers, Brackets, Etc.

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Yale & Towne Chain Blocks.

Pratt & Whitney Small Tools.

Pratt & Whitney Standard and High Speed Drills.

Norton Emery Wheels.

Oster Stocks and Dies.

Chucks, Drill Chucks

Starrett's Tools

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Fairbanks "Extra" Belting.

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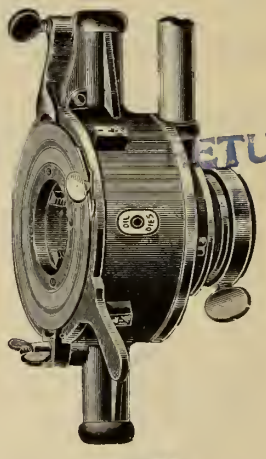

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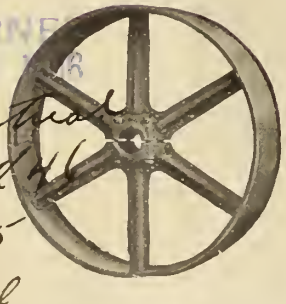

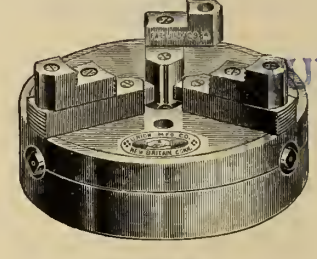

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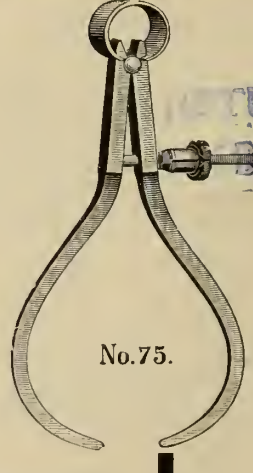

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Modern Canadian Manufacturing Plants.

ARTICLE XI.—The Canada Car Company, Limited, Montreal.

ONE of the newest and most up-to-date of large Canadian manufacturing plants is that of the Canada Car Co., Limited, at Montreal. The first sod in the construction of the plant was turned in October, 1904, while on October 14 last the production of cars first began, thus coming close to forming a record for rapid construction in Canada. Some of the details of construction of this plant were given in a former issue. Owing to the vast amount of detail work necessary to produce perfect results, the shops have by no means reached their full capacity, which will be about twenty-five cars a day. However, the daily output has been steadily increased, and has now reached the respectable total of eight freight cars a day, while, on account of the non-arrival of material, work has not advanced very far in the passenger car department.

View from Upper Lachine Road—Canada Car Company's Plant.

The ideal situation of the works, with the Lachine Canal to the south, and the Grand Trunk main line immediately to the north, will at once appeal to the visitor as affording the best possible facility for the arrival of raw material and the delivery of the finished car.

At the west end of the plant is situated the lumber yard, a system of overhead carriers bringing the lumber from the canal to the yard and thence, when desired, to the planing mill. A spacious dry kiln is convenient to the lumber yard, and in the vicinity, too, is situated the stores department, where a fine system is in operation, practically all the metal used in constructing cars being here under cover.

The Planing Mill.

Entering the works at the west end, we come first to the planing mill, a room 365 feet long by 70 feet wide, where the first machine encountered is a band rip-saw, which is used when necessary before the planer. Two large No. 41 Berlin timber planers take care of the sills and all heavy timbers going into the cars, dressing them on four sides simultaneously. Each of these planers is driven by a 75 h.p. motor. The lumber next goes to a cut-off saw, where it is cut to proper lengths and marked off, after which it is taken to the tenoning machine installed by Greenlee Bros. & Co. The boring machines, horizontal tenoner and hollow chisels in succession, are put to work on the timber, which is then ready for the erection shop. Smaller timbers, such as belt rails, after going through a 16 x 5-inch planer, and the cutting saws, are marked off for boring and hollow chiselling, after which operations they are put in readiness for the erection shop by the tenoners. With the exception of one small group, every separate machine in the planing mill has its own motor, and is perfectly independent of every other machine. These are three-phase, 60 cycle, 550 volt induction motors of Canadian Westinghouse make.

Adjacent to the planing room is the department given up to turning out tongued and grooved flooring, siding and roofing for box cars. The dimensions of this department are 215 feet by 70 feet. A band rip saw, three 6 in. by 15 in. lightning floorers, or planers and matchers, and three automatic cut-off saws, constitute the main mechanical features of this department, but there are also several miscellaneous machines, such as molders and surfacers.

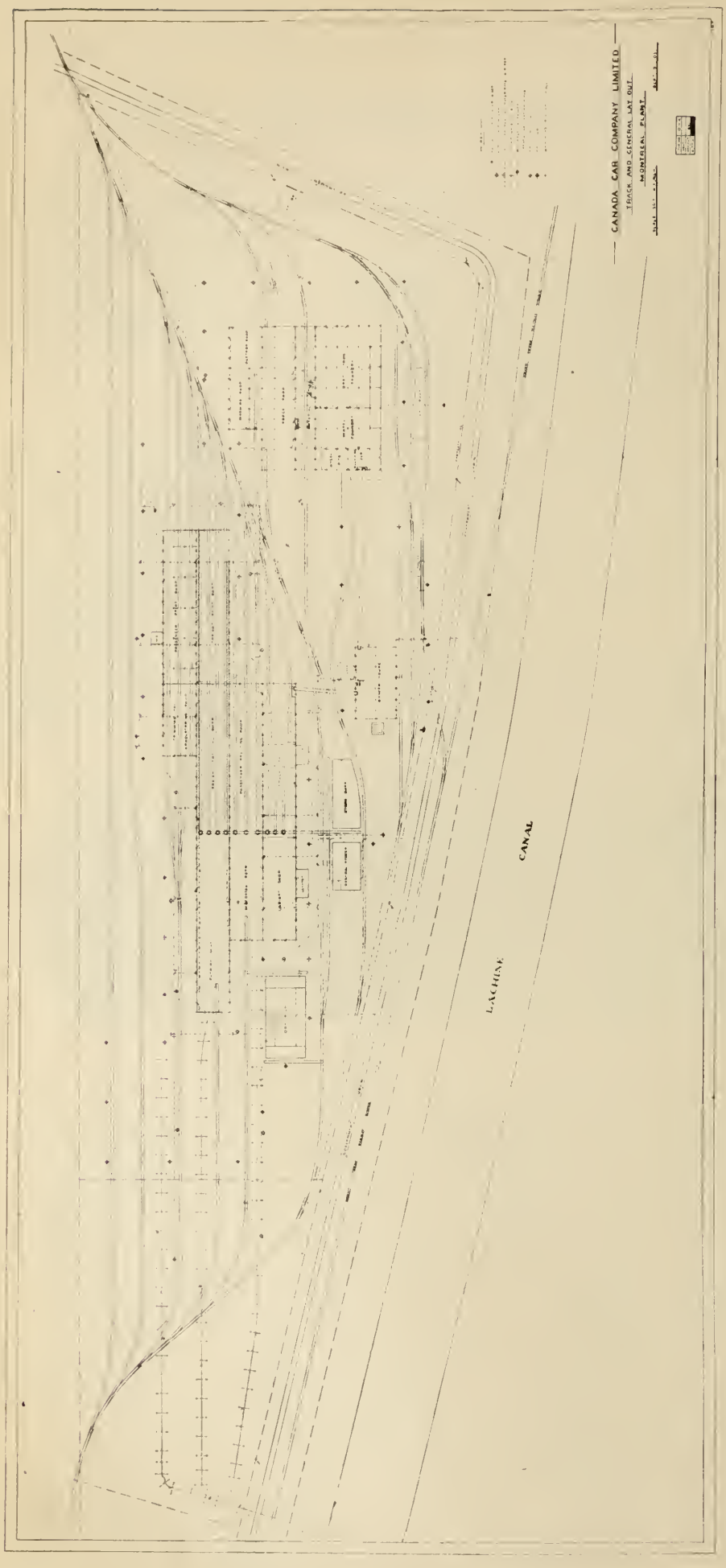
The rough material for flooring, siding and roofing, is brought in and put through the planing and matching machines to surface it, and make the tongue and groove. It is then passed on to cut-off saws, which cut the boards to proper lengths, when they are ready for the erection shop, or door department, as is necessary.

Erection of the Cars.

After the material has passed through the planing and matching rooms, the next step is the assembling, which is done in the erection shop. The trucks come to this shop more or less complete, and the body bolsters are put into position to receive the sills. Piece by piece the various parts are put together, until the car is finished, when it is pushed out into the next department, which is the paint shop.

The Paint Shop.

In this shop the cars are given the required amount of paint, which is sprayed on by air pressure. The air piping and general air brake equipment



Canada Car Company, Limited, Montreal—Track and General Lay Out.

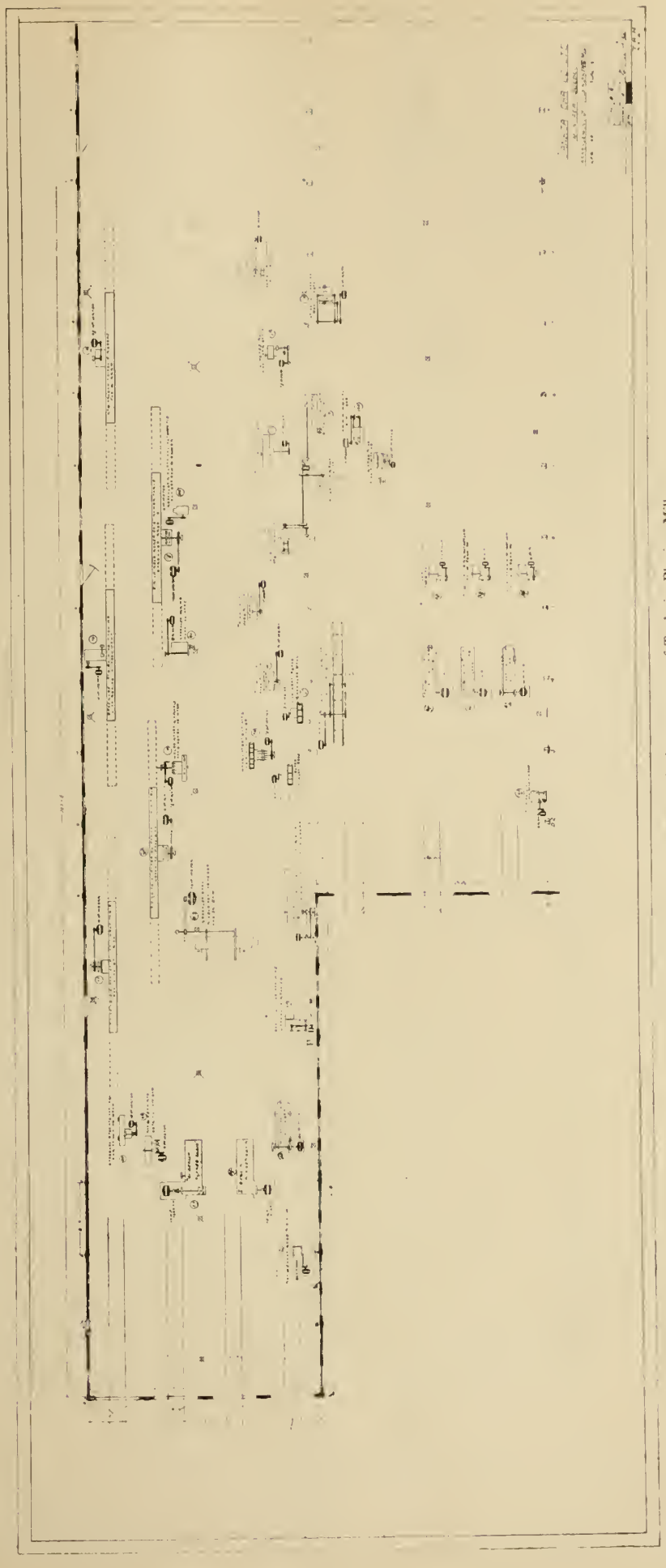
is also applied in this room, and the cars are then tested and weighed, preparatory to being delivered to the various railroads and put into service. All these departments are under one roof.

We have now traced the progress of the lumber, from the time it enters the lumber yard by overhead travelers until the freight car leaves the paint shop ready for delivery. But it is really of greater interest to note the various processes undergone by the metal parts of the car in another building containing the different departments for these operations.

The foundry is said to be the most modern in Canada, and has been equipped throughout by the Whiting Foundry Equipment Co., of Chicago. To the south of the foundry is kept the supply of such material as coke, pig iron, scrap iron and steel. A pneumatic trip hammer is here employed to break up old wheels, while a Fairbanks scale, convenient to the breaker, permits the workmen to load transfer cars with the correct proportion of pig iron, scrap and steel. They are then run into the foundry room and raised to the charging floor on a pneumatic hoist. The grey iron and wheel foundries are connected, but there is a separate hoist for each foundry, so that, if one goes out of order, the other can do double duty. The charging room is the best in the country, with capacity to store a week's material if necessary. This is an important consideration in a climate such as ours.

When the transfer cars have been hoisted to the charging floor, they are run along the tracks to the cupolas, of which there are four, two for the grey iron and two for the wheel foundry, with capacities ranging from 10 to 20 tons. A charging device, the first of its kind in this country, has been installed here. The truck bearing the charge comes to a stop on a platform, which, by the agency of compressed air, is tilted up so as to dump the charge into the cupola, thus saving a great deal of time. On a sub-floor are situated two Roots' Blowers, No. 7 and No. 6, supplying blast for the wheel and grey iron foundry, respectively. Both are connected with the main blower line and either can be used if the other breaks down.

In the foundry proper one is greatly impressed with the fine track system for delivering iron. The tracks and turntables are so arranged that the molten metal can be delivered to all parts of the shop. A feature of the grey iron foundry is the Whiting patent roller drive tumbler for cleaning the castings. From the machine the castings are taken to the door, weighed and



Canada Car Company, Limited, Montreal—Arrangement of Tools in Planing Mill.

put on cars to be transferred to the erecting shop.

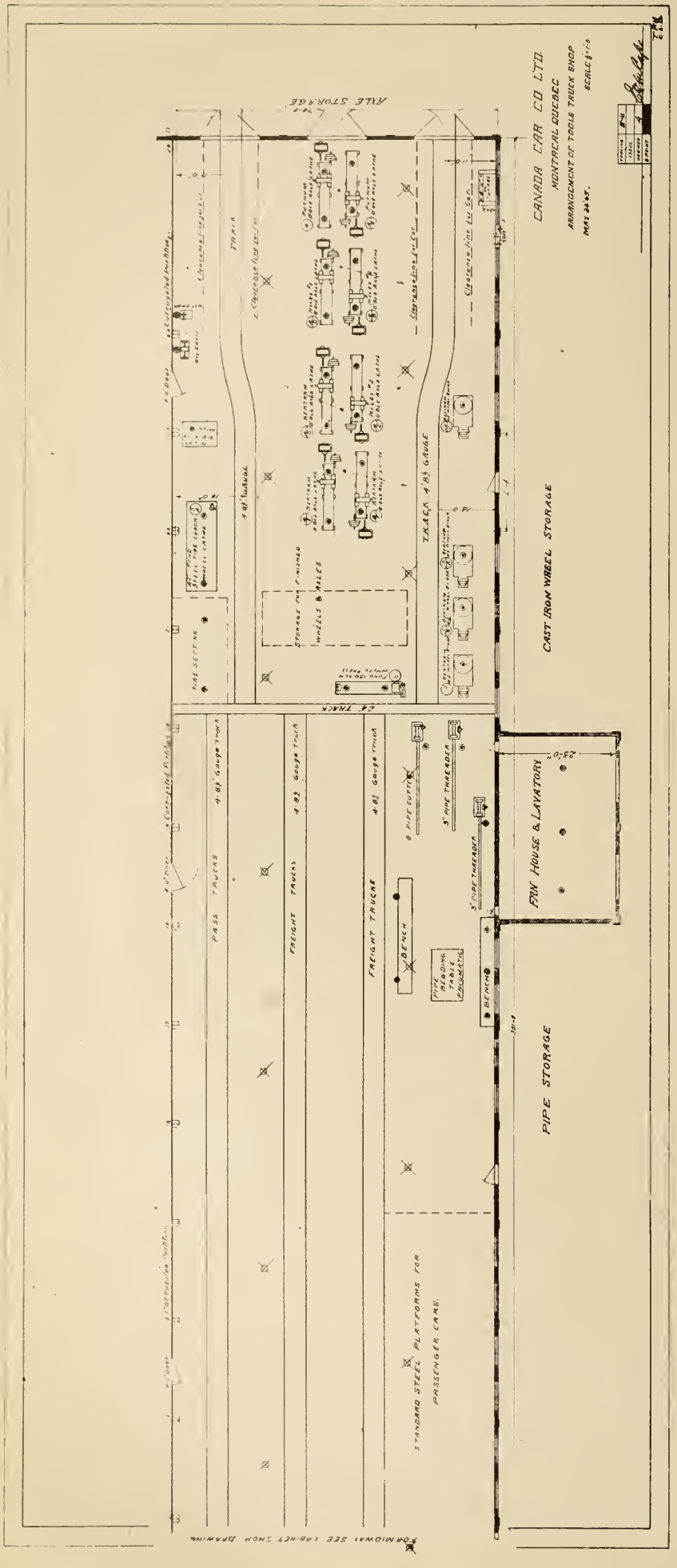
In the wheel foundry are cast the car wheels, the system of tracks and overhead carriers making it able to turn out the wheels with clock-like regularity. The whole foundry is arranged for a daily output of three hundred wheels. After the wheels have solidified in the molds, they are carried down to the transfer cars, and then taken to the annealing pits. These pits, numbering 96 in all, are 12 feet deep and lined with 4½ inches of firebrick, and have an individual capacity of 18 wheels. This allows for a daily production of 300 wheels, giving sufficient time to anneal. A Whiting pitting crane of 3,000 lbs. capacity, equipped with a double hoisting device, works the full ten hours of the day, taking out the wheels in the morning and depositing them in the afternoon. The core ovens, which are equipped with rolling doors, are also arranged to contain 300 pan cores and 300 centre cores. They are very compact, and no space in them is unused. There is in connection with the plant a splendidly equipped pattern shop with the machines necessary to turn out patterns for the grey iron and wheel foundries.

Forge and Smith Shop.

One of the most interesting departments in the plant is the forge and smith shop, where all the wrought iron work is done for the cars. The iron storage is at the east end of the shop. From here the material is brought in and sheared to proper lengths, being then marked off and forwarded to various machines to be upset, shaped, punched or drilled, or put through any of the necessary operations to finish it properly for delivery to the erecting shop. Among the heavier machines in this shop are an Acme Machine Co.'s 4-in. upsetting machine, an Acme 3-in. upsetter, a Williams & White bulldozer No. 8, and some smaller sized bulldozers, a Bement-Niles 2,000 lb. double legged steam hammer, and numerous other machines of larger or smaller capacity, for the various operations that are required for the blacksmith department of a car shop. All the furnaces in the smith shop are oil burning, with an air blast of about 10 ounces.

Machine Shop.

In connection with the forge and smith shop, there is also a machine shop, which takes care of the making of the dies, and any necessary repair work for the plant equipment. Among the machinery features here are a large planer and lathes from John Bertram & Sons, Limited, Dundas, and a Brown & Sharpe milling machine.



Canada Car Company, Limited, Montreal—Arrangement of Tools in Truck Shop.

The Truck Shop.

A very important part of the work is performed in the truck shop. Here the axles (made of best forged steel) are turned out and the wheels are bored to prepare for the 150-ton hydraulic wheel press which presses the wheels on the axles. They are then delivered to the erecting floor, where the trucks are assembled. For turning the axles the most improved of double-headed axle lathes of three different makes are employed. These are the Putnam, Niles and John Bertram & Sons' lathes. For the boring of wheels there are 4 Bertram 48-in. wheel borers.

From the wheel press the wheels are taken to the erecting floor, where are also delivered the arch bars, truck bolster materials, castings, and other pieces of iron work, which come from the foundry and forge shop. These pieces of material are then assembled and the completed truck is ready to go to the erecting shop, where the freight cars are built.

Passenger Car Construction.

We have thus described the process undergone in the erection of freight cars. The process of manufacturing passenger cars is very similar, though the work is of a finer grade.

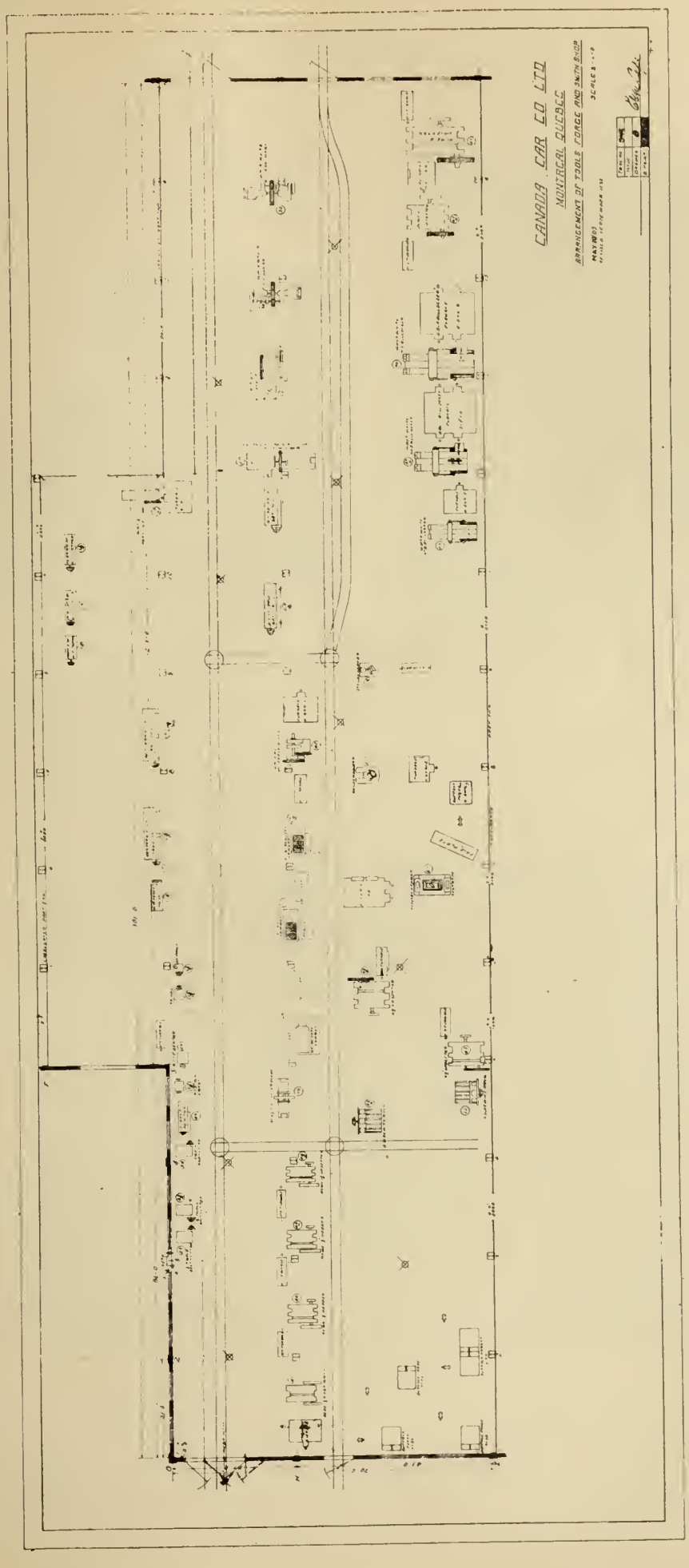
The planing and matching rooms will take care of the sills and rougher material, and deliver it to the passenger erection shop, which is adjacent to the freight erection shop. The wheels and axles will be finished in the truck shop, and transferred to the truck erecting department with the iron work from the forge shop. There is one track on the erecting floor of the truck department which has been reserved for the building of passenger trucks. After they are assembled they will be delivered to the passenger car erecting shop.

To produce all the inside finish and the finer grade of wood work that goes to make up the modern passenger coach there is a cabinet shop supplied with machines adapted for turning out this kind of wood work.

After the passenger cars have been erected, that is, after the wood work is completed, and the framing and most of the inside finish in place, the cars will be taken to the passenger car paint shop, where they will be given their different coats of paint and varnish. They will then go on to the upholstering department, where they will be completed and made ready for delivery to the railroad.

Traveling Cranes.

In the matter of traveling cranes, such as are absolutely necessary in a shop requiring so much heavy lifting as this plant, the Canada Car Co. is in-



Canada Car Company, Limited, Montreal—Arrangement of Tools in Forge and Smith Shop.

deed well equipped. In the planing mill there is a 7½ ton Niles electric traveling crane of 68 feet span, and a similar one does duty in the matching room. Two cranes of the same capacity and about 24 feet span do the heavy carrying in the forge shop. Scattered throughout the works, wherever they will be useful, are about twenty jib cranes of from 1 to 2 tons capacity, and a number of smaller cranes will be installed to look after the lighter work. These jib cranes were furnished by the Northern Engineering Co., of Detroit.

A feature that must not be overlooked is the heating system, which has been said by many experts to be the finest in any similar plant in the world. Throughout the works an even temperature is kept. the perfect working of the system reflecting great credit upon the Miller Heating Co., who installed it.

Speaking generally, the machinery in this plant is laid out in an almost ideal manner, and the ease with which the material goes from one process to another until the finished product issues from the works, has been remarked upon by almost every visitor.

AN EVIDENCE OF PROGRESS.

KER & GOODWIN, of Brantford, Ont., machinists and machinery manufacturers, have been in the supply and machinery business for only eight years, but in that time have built up a trade that at first though merely local has extended to all parts of the Dominion. A little over two years ago they turned out their first goods in the way of manufactured articles and since that time have been steadily advancing. Early in the year 1905 it was recognized that increased premises and further facilities for manufacture should be obtained to keep up with the expansion that had been in progress for some time. A new factory was proposed and on April 10 work was commenced on a new plant on Colborne street, Brantford. Such good progress was made that on August 1 the old premises were vacated and Ker & Goodwin became established in their fine new quarters. A further complement of machinery was added. From that time work has been rushed, and as yet there is no sign of overtaking business already on hand.

The new building is 70 x 40 feet, solid brick, on cement foundations, of the slow burning mill construction type. It is two storeys high. In addition to this there is a separate boiler house of the same material, 18 x 19 feet.

On the ground floor the front part is

attractively divided off into office and stock rooms, the former being neatly fitted up and installed with all modern office equipment. In the stock room are kept the small supplies that are in constant demand in a machine shop of this kind. The remainder of the ground floor is devoted to a machine shop. The upper story is used entirely for patterns and storage. The power house contains besides a suitable steam engine and boiler of ample capacity, a case hardening furnace, and an air compressor. The machine shop is equipped in a complete manner with different styles and patterns of lathes, light and heavy drills, milling machines, drill grinders, universal tool grinder, shapers, etc., being ample to deal with the varied demands made upon them in these works.

Fig. 1.—Threading Jaws. Ker & Goodwin, Brantford.

Fig. 2.—Turning Screws. Ker & Goodwin, Brantford

Besides a large variety of repair work of all classes, both light and heavy, this firm have gone extensively into the manufacture of a special line of chucks of their own design. These have been placed on the Canadian market recently and are meeting with a splendid reception from the trade. It is intended to branch into other lines later, and following out the energy and capability already shown, no small success is assured for the future.

The firm consists of Messrs. J. Ker and A. Goodwin, two young men whose enterprise is shown in their undertakings. The illustrations given herewith may leave some impression of the work that is being done in this new plant.

BIG POWER DAM PROGRESSING.

Work on the water power development at Fort Frances is being pushed forward as rapidly as possible. Two large towers have been erected on either side of the river and the aerial tramway placed in position. The machinery required for construction purposes is now installed and in operating order. 12,000 barrels of cement have arrived and work on this important piece of construction will be completed at as early a date as possible.

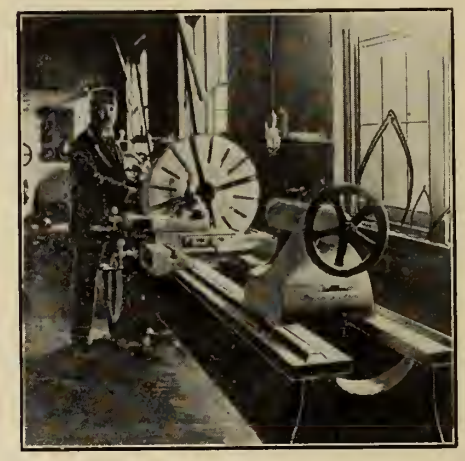


Fig. 3.—Turning 24-inch Bodies. Ker & Goodwin, Brantford.

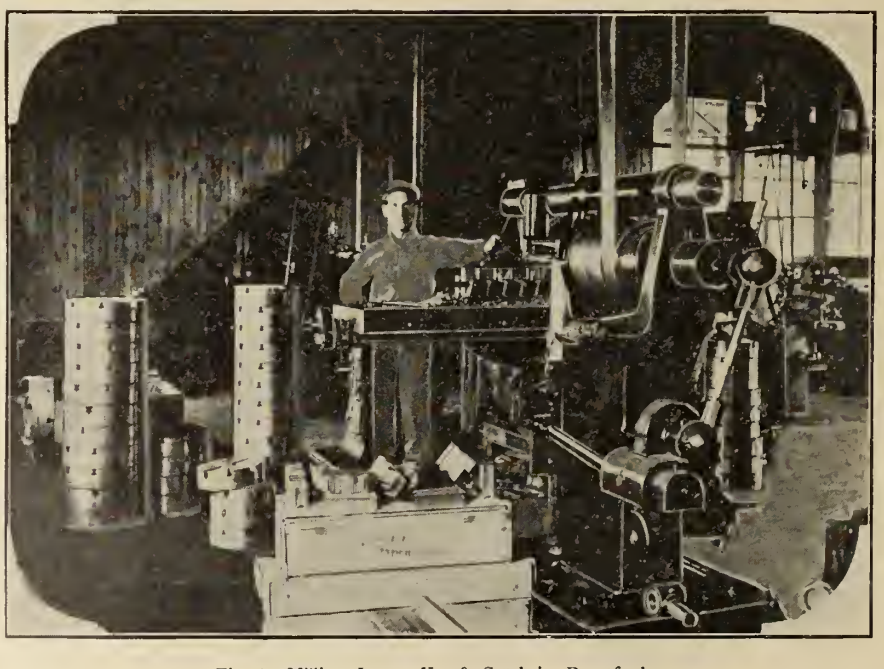


Fig. 4.—Milling Jaws. Ker & Goodwin, Brantford.

A RESOLUTION.

Whatever your present self may be, resolve with all your strength never to degenerate thence.—C. Bronte

The Allis-Chalmers Steam Turbine

BY the recent starting up of a steam turbine at the Washington street power house of the Utica Gas & Electric Company, Utica, N.Y., attention is called to the fact that this is the first turbine to be put into operation by the Allis-Chalmers Company, who have recently entered the steam turbine field. The turbine outfit installed at Utica is shown by the accompanying Figure 1.

This turbine is rated at 1,500 k.w. normal load, and runs at a speed of 1,800 revolutions per minute. It is direct coupled to an Allis-Chalmers 2-phase, 60-cycle revolving field alternator, operating at 2,500 volts. The unit has a continuous overload capacity of 25 per cent., with a 3-hour 50 per cent. overload capacity without exceeding a safe generator temperature, and capable of a 100 p.c. safe momentary overload. Artificial ventilation by means of an

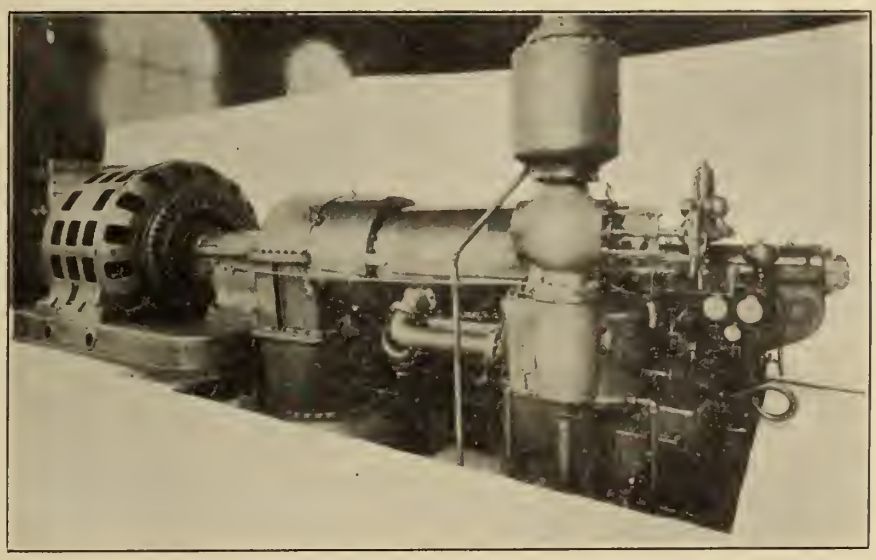


Fig. 1.

electrically driven fan blower will, however, enable the unit to be run safely beyond its rated overload capacity.

Features of This Turbine.

The turbine follows the well known Parsons type which has proven itself eminently successful in numerous installations both here and abroad. The Allis-Chalmers construction, however, embodies a number of features which are new in this country, and which are claimed by the builders to be distinct improvements.

The chief distinguishing feature of this construction is the blading, which, while it is of the Parsons reaction type as regards the principle of operation, differs in mechanical construction in a number of essential details.

The roots of the blades are formed in dovetail shape by special machinery, and are inserted in slots cut in foundation or base rings; these slots being formed by special machine tools in such a way as to exactly conform to the shapes of the blade roots. The foundation rings themselves are of dovetail shape in cross section and are inserted in dovetailed grooves cut in the turbine cylinder and spindle respectively, in which they are firmly held by key pieces, much in the same way that the well known "Lewis" bolt is fastened. In order to further insure the integrity of the construction, the key pieces or rings after being driven into place are upset into undercut grooves.

Another noticeable feature of the blading is the method of reinforcing and protecting the tips of the blades. This point in steam turbine design is one upon which much thought has been expended by various inventors, and the Allis-Chalmers Company claim that the construction employed by them successfully solves all difficulties. In forming the blades a shouldered projection is left at the tip. This is inserted in a slot punched in a shroud ring, the slots being punched by special machinery in such a way as to produce accurate spacing and at the same time form the slots so that they will give the proper angles to the blades independent of the slots in the base ring. After the blade tips are inserted in the slots in the shroud rings they are riveted over by specially arranged pneumatic machinery.

The shroud rings are made in channel shape, with outwardly projecting flanges which, after assembly in the turbine,

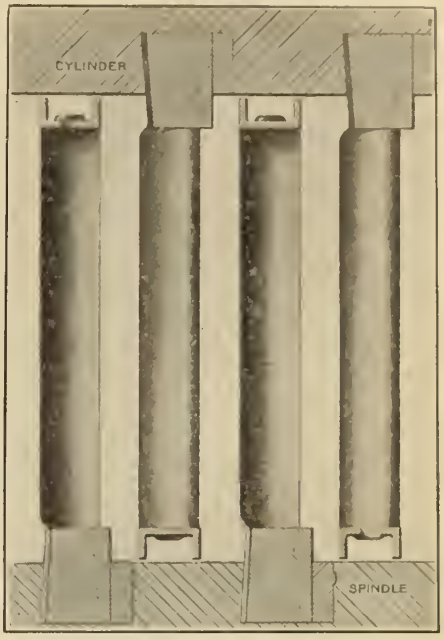


Fig. 2.

are turned and bored to give the necessary working clearance. The flanges of the channels are made so thin that, although amply sufficient for stiffness, the shroud ring does not have the disadvantage of a solid shroud which acquires a dangerous temperature by friction in case of an accidental contact of the rotating and stationary parts. It is claimed for this construction that the blades are stiffened against the effect of vibration in a much more substantial manner than by any other means thus far employed, while the use of a protecting shroud ring enables the working clearance to be made smaller than in the case of naked blade tips, without danger in case of accidental contact, thus reducing the leakage loss to a minimum, the leakage past the blade tips being the principal source of loss in the steam turbine.

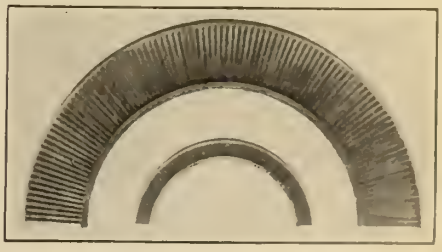


Fig. 3.

As to the safety from damage in case of accidental contact, it is claimed that this has been proven by experiment with

actual blading, by throwing the bearings out of centre so as to produce contact, without detrimental results. An incidental advantage claimed for this construction is that if by chance a blade should prove defective, it is so held in place by the shroud ring that it cannot possibly work loose and produce damage.

By the method of construction described, the entire blading is produced by machinery, thus eliminating the personal equation which enters into blading done by hand work, which depends upon the skill of the individual workman. Besides ensuring that every blade is securely fastened, all blades are necessarily set at exactly the designed angle and pitch, the openings between blades, upon which in great part the economical performance depends, being absolutely uniform. The blading is made up in half rings in the blading shop and is carefully inspected before being inserted in the turbine.

Figure 2, which was photographed from a drawing, shows the general scheme of the blading, illustrating the

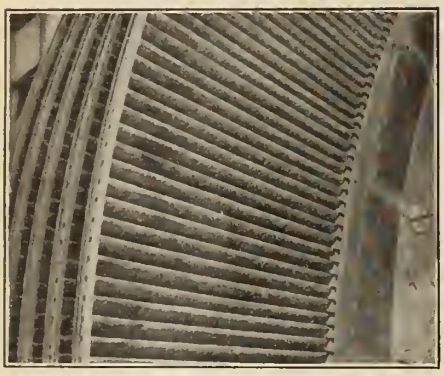


Fig. 4.

method of fastening the blades as well as the channel shaped shroud ring. Figure 3 shows two half rings or blades ready for assembly in a turbine; these half rings being respectively the smallest and largest ones, used in a turbine of the size installed at Utica. Figure 4 is from a photograph of blading, showing the substantiability of the construction as well as the uniformity of the work. Figure 5 shows a turbine spindle of the same size as that of the Utica turbine, this photograph having been taken in the West Allis shops of the Allis-Chalmers Company.

Another special feature of this turbine will be noticed by referring to Figure 5, viz., the absence of the usual low pressure balance piston, the photograph showing only two balance pistons instead of the three pistons formerly used in this type of turbine, where it is said to have been found difficult to produce a balance piston of the size required for balancing the low pressure stage of the turbine and at the same time make it sufficiently rigid to run with the necessary small working clearance. In the Allis-Chalmers construction there is, however, a third balance piston, but instead of being at the high pressure end of the turbine, as formerly arranged, it is at the low pressure end, and as it is smaller than the large end of the spindle it is hidden from sight in the photograph. By making this piston in such a way that its circular area is equal to the annular area of the pistons used in the older construction, the low pressure balance piston is made much smaller. Instead of reducing the leakage past this piston by means of "dummy packing," as in the high pressure and intermediate pistons, and as used in the low pressure pistons of the older construction, a labyrinth packing of radial baffling type has been adopted, thus eliminating small axial clearance in this turbine. A considerable advantage is claimed for this construction in permitting of the use of smaller working clearances in the high pressure and intermediate balance pistons.

There are a number of other points of improvement claimed for the Allis-Chalmers construction which will not permit of description within the space of the present article. These include details of spindle construction, governing mechanism, lubrication, and other minor features.

The alternating current generator of the Utica outfit also is deserving of more description than the present article will allow. Perhaps the most noticeable feature of this generator is the substantial design of the revolving field, providing great strength and at the same time giving the thorough ventilation which is essential. Particular attention has been paid to the insulation, as may be inferred from the fact that the armature (Figure 6) was subjected

Fig. 5.

to an alternating current insulation test of 10,000 volts for the period of fifteen minutes. This generator was built at the Bullock works of the Allis-Chalmers Company at Cincinnati, where the generators for all of their other turbine outfits are being built.

COMPETITIVE HIGH-SPEED STEEL TEST.

SOME idea of the number of high-speed steels on the Canadian market and the keen competition existing amongst the different manufacturers and agents thereof, has been shown lately at the C.P.R. Angus shops, Montreal. The management decided to find out from actual tests, in the well equipped machine shop, the merits and demerits of the different steels for the particular work required of them in locomotive building. It will be a surprise to many to know that no less than twenty-two different grades and brands were submitted. The tests carried on were of a more searching character, so that the officials should be fully satisfied when the final decision is reached.

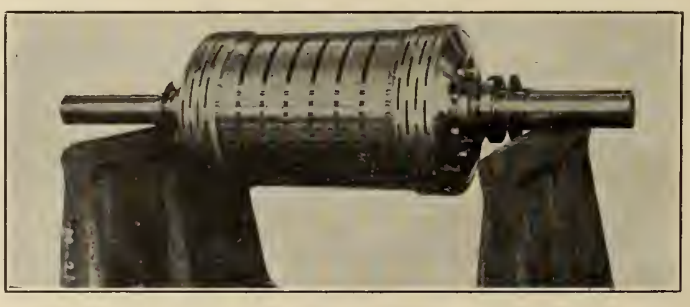


Fig. 6.

AN IDEAL.

Begin, live, aspire, realize the best ideal of the moment, and this earnest effort shall lead the way to greater achievement.

—H. W. Dresser.

ENGINEERING NEWS

AND BUSINESS NOTES

SOCIETY OFFICERS.

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Canadian Electrical Association.

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Canadian Association of Stationary Engineers.

President, Wm. A. Sweet, Hamilton: vice-president, Jos. Ironsides; secretary, Wm. Outhwaite, Toronto; conductor, Ed. Grandbois, Chatham; doorkeeper, Chas. Kelly, Chatham.

Ontario Association of Stationary Engineers.

President, Geo. Fowler, Toronto; vice-president, W. F. Chapman, Brockville; treasurer, Charles Moseley, Toronto; registrar, W. G. Blackgrove, Toronto

Canadian Railway Club.

President, S. King; secretary, James Powell, chief draughtsman motive power department, G. T. R. treasurer, S. S. Underwood, chief draughtsman car department, G T. R

An Interesting Meeting.

THE members of No. 1 Canadian Association of Stationary Engineers, together with their friends, were treated to a very interesting blackboard talk by Mr. James Milne, manager and chief engineer of the Underfeed Stoker Co., Toronto.

The matter treated on consisted of three headings (1) the amount of water required for condensing purposes, (2) from and at 212 degrees, (3) heating by electricity.

Under the first heading Mr. Milne treated very fully, and showed by successive stages as to how certain formulae were arrived at and brought out the following rule:

To 1114.4 add 3-10 of the temperature of the steam entering the condenser and from the sum subtract the temperature of the hot well. Divide by the difference between the initial and final temperature of the injection water, and the answer will be the number of pounds of water required per pounds of steam for condensing purposes.

Under heading No. 2 Mr. Milne treated on boiler testing and showed that in order to make proper and fair comparisons between boilers operating under different conditions as to feed temperature and pressure, the only correct basis was from a feed water temperature of 212 degrees to steam at 212 degrees.

Prior to commencing this section, a heat computor, designed by Mr. Milne, was distributed to the members present, for one of which Canadian Machinery begs to thank the Underfeed Stoker Co. This computor is for determining practically all calculations pertaining to steam. Once the feed temperature and gauge pressures are known by a movement of a slide, the factor of evaporation and equivalent evaporation from and at 212 are determined at once. Every engineer should have one.

The talk on heating by electricity was certainly interesting and showed quite conclusively that even when electric power was delivered from Niagara to Toronto there was little hope of the houses ever being heated by same.

With electricity at 2 cents per kw, it was proven that it was seven times more expensive than heating by steam or hot water system, using hard coal, and using soft coal it was thirteen times more expensive.

After the lecture was over Mr. Milne received a very flattering testimonial from Mr. A. M. Wickens, which was seconded by Mr. Charles Mosely.

Mr. Milne leaves for British Columbia at the end of January to assume the position of general superintendent of the B C. Railway Co., and the C.A.S.E. wishes him every success.

* * *

Prizes to be Awarded.

EVERY year the Canadian Society of Civil Engineers awards four prizes for papers presented to the society by student members. These should arouse an enthusiastic interest on the part of every student member and cause him to set out with the idea of winning one of these prizes of twenty-five dollars. During the past they have been won for the most part by McGill men, the student members from other institutions not having competed to the same extent. December 31 is set as the last day these papers should be in the hands of the secretary, Prof. C. H. McLeod. It is hoped that anyone who has missed the opportunity this year will get busy and whether he proposes entering the field of civil, mechanical, electrical or mining engineering that he may have an ambition to win this prize another year.

* * *

Geologist Honored.

At the meeting of the Mining Society of Nova Scotia held at Halifax, Mr Hugh Fletcher, B.A., of the Geological Survey Department, was presented with an address accompanied by a gold watch, chain and aneroid. The address characterized Mr. Fletcher as a gentleman who by his untiring energy and patience has been most successful in causing the unlocking of nature's secrets and throwing open the door to those who wish to grasp the opportunities.

* * *

Provincial Mining Society.

At the recent Ontario mining conference it was decided to form an independent provincial organization, as the miners of different sections had decided to form local societies. The report of the committee on organization favored this and the general body seemed to be of the same mind. The name "Ontario Mining Association" was proposed. Residents of Ontario and non-residents interested in mines in the province to be eligible for membership. The annual fee, it was suggested, should be $2; the officers, president, vice-president, secretary-treasurer, and nine others, the whole to form the executive. The first executive should, it was recommended, report upon a constitution. The question of affiliation with the Canadian Mining Institute was discussed but nothing definite was arrived at.

* * *

Electrical Engineers Meet.

The Toronto branch of the American Institute of Electrical Engineers met at the School of Practical Science on the evening of December 22. An interesting paper by Mr. E. B. Walker on "The Booster Control of Storage Batteries" was read.

* * *

Awarded Gold Medal.

Interesting news has been received by the Chicago Pneumatic Tool Co. from the Jury of Awards of the Liege Exposition to the effect that they had been awarded both gold and silver medals for their exhibits. The gold medal was the highest given for pneumatic tools and appliances and the silver medal was granted for Franklin Air Compressors. This is a high tribute to the class of goods manufactured by the Chicago Pneumatic Tool Co.

CANADIAN
MACHINERY
AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, technical progress, construction and improvement, and to all users of power developed from steam, gas, electricity, compressed air and water in Canada.

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New Advertisers in this Number:

Canadian Co-Operative Co., Winnipeg.
Hamilton Pattern Works, Hamilton.
Power and Gas Machine Co., Galt, Ont.
Otis-Fensom Elevator Co., Toronto.
Sylvester Mfg Co., Lindsay, Ont.

A HAPPY NEW YEAR.

TO all the readers of Canadian Machinery we extend our best wishes for a Prosperous and Happy New Year, and express the hope that it may see your expectations fulfilled and your ambitions realized in so far as that is possible within one year.

No people living to-day have greater cause for thankfulness, for the blessings of the past, than the citizens of the Dominion of Canada. No people can look forward into the year upon which we are now entering with greater hope and confidence. All this should go towards making thankful hearts, a contented people and promote a high sense of citizenship. With what the coming year promises the people of Canada generally, there is every indication of a further tide of prosperity and we hope that every reader of this paper may share it in no small measure.

UNION OF CAPITAL AND LABOR.

SO much is being said from time to time on this problem and the difficulties confronting those most vitally interested that little else seems possible of expression. As long as the employer feels it is an imperative duty to keep his workmen under his thumb and does his best to accomplish that end, and as long as the workmen feel antagonistic to the men whose brains and foresight have created the industry in which they are engaged, little can be hoped for in the way of progress Different systems of payment of wages have their special advantages and drawbacks.

The nearest solution of this vital question seems to have been reached by the manufacturing industry at the head of which is Mr. Theodore Cooke Taylor, member for the south-east division of Lancashire in the British House of Commons. In an address before the Canadian Club some weeks ago Mr. Taylor explained his position and the position of his company on the subject. The industry in question is a woollen manufacturing business that has been in the family for four generations and employs 600 hands. They consider that the employees have a definite claim on the employers, and as such are entitled to share in the profits at the end of each year's business. Following out this they set aside every year a proportion of the profits. These are given to the workmen in the shape of one pound shares, which have no voting power, but upon which dividends are paid. Thus the interests of capital and labor are made identical, as every dollar profit to the firm means a certain amount to the men. This has passed the experimental stage, having been given thirteen years' trial, so that Mr. Taylor had ample chance of studying any drawbacks the system might offer. He stated that in his opinion it was the only method of solving the problem between capital and labor, and no doubt there is sound logic in his argument.

Of course such is more possible of being put into execution by an old established firm that has had every opportunity to know its exact position than with comparatively newly established industries such as represent the large majority in Canada.

With the adoption of this system the golden age of labor would be an accomplished fact. As this country increases in wealth, in population and in developed resources, many of the firms established and on a sound basis to-day will probably before long be in a similar position to the English industry mentioned. As a matter of general progress in manufacturing, the establishment of the profit sharing system, as carried on in England, would elevate the standard and give an added tone to industrial affairs in Canada.

FAKE INVESTMENT PROPOSITIONS

SOME time ago Canadian Machinery drew attention in its editorial columns to the preposterous claims which were being put forward in the daily press by the promoters of a company destined to manufacture a motor of surpassing excellence. The Mite-e-motor was the name of this wonderful machine and the company's prospectus which was published in commanding type by many daily newspapers throughout the country, modestly remarked that it was "the most marvelous invention the world has known." A company known as the Canadian Turbine Propulsion Power & Light Company was organized to produce this great machine, and the public were given the privilege of purchasing stock in the company at five dollars a share.

At the time (about a year ago) a representative of this paper attempted to get full information on the design of the motor, but without success, as the company's promoters always had a score of excuses for not showing the working model or the detailed drawings. Naturally the conclusion arrived at was that the claims advanced for the Mite-e-motor could not be substantiated, and that an

effort was being made to entice the ignorant and unwary into sinking their money in this fictitious company. Our readers were warned against being gulled by the specious promises of the promoters and the Canadian Turbine Propulsion Power & Light Company was challenged to produce a machine that would fulfill anything approximating the claim advertised for the Mite-e-motor.

Since that time the wisdom of our course has been shown, as absolutely nothing has been done to place on the market "the most marvelous invention the world has known." The Canadian Turbine Propulsion Power & Light Co. has quietly dropped out of the limelight, and if it were not that a rank fraud has been prepetrated on the investing public, the subject might be allowed to rest.

But it is beyond question that some people have been made to suffer by putting money into a concern which they thought would manufacture an article tending to revolutionize the industrial world. It is also quite conceivable that a goodly proportion of these investors could ill afford to lose their money. But how can they hope to have it restored ?

It is high time that some move was made on the part of our legislators to protect the public against these harpies of finance, who ruthlessly take advantage of those who lack the knowledge requisite to a correct understanding of such wild-cat schemes. Under existing laws fakirs can with impunity float companies that exist on paper only, and always some section of the country is robbed of hard-earned money. The disclosure of the real status of these fake companies never seems to come until it is too late. And the pity of it is that the "men behind" escape the clutches of justice, and are emboldened to still further exertions of a similar character.

Within the past few years Canadians have been growing richer, and in consequence the harvest of fake promoters has been great. Everywhere the greatest ease has been experienced in securing subscriptions to stock in questionable investment companies of all kinds, mining companies, and, as in the case under discussion, industrial companies. But the great mass of our people must soon demand that action be taken to prevent swindlers from preying upon their bank accounts. The public are protected against pickpockets and housebreakers. Can larger and bolder operators be safely neglected ?

LONG POWER TRANSMISSION.

ONE hundred and eighty-two miles is the enormous length of the Mexican Light & Power Co.'s new transmission line over which power was transmitted for the first time early in December. This is an engineering feat of no small significance. Interest is added to the fact when it is known that the above company is entirely Canadian and the development referred to due to Canadian brains and capital.

MINERAL PROSPECTS.

SINCE the mining boom in British Columbia a few years ago, and the Klondike gold discoveries, there has been a steady though somewhat less spectacular movement in mining affairs in Canada. Discoveries made within the past two years have proven beyond a shadow of a doubt that Canada's future as a leading mining country for years to come is assured. From the Atlantic to the Pacific there are to be found minerals comprising almost the entire line of commercial metals, some of which are the richest of their kind. From the coal and iron of Nova Scotia and Cape Breton to the gold of the Klondike these will be wealth produeers for the present and future generation.

The report of the electric smelting operations being carried on under Government supervision at Sault Ste. Marie giving every indication of a commercial application and proving the economy of electric smelting stimulates the mineral strength and wealth of Canada in no small measure. With the inauguration of this process on a commercial basis the water powers of the north will be harnessed to reduce the mountains of iron ore and make Canada the greatest iron producing country of the world.

In this country are to be found nearly all the mica in America as well as the richest veins of asbestos ever discovered. The recent startling finds of silver in the Cobalt district show to some extent the possibilities of Northern Ontario mining, these latter being conceded the richest finds of silver yet made. The nickel of the Sudbury district is already famous, the enormous amount of which has never been duplicated in the history of the mineral discoveries of the world.

Some idea of the value of Ontario's minerals during the nine months ending with September is given in the report of the Director of the Bureau of Mines, who uses for the purpose the selling price of the products at the mines or works. The total value of these for the nine months mentioned is given as $9,000,000, which means that as refined metals these ores estimate an amount equivalent to twice that at least. Of this amount $3,890,000 represents nickel and silver. With such an enormous production of valuable ores it is a strange fact that as far as present development goes these cannot be refined in this country. Such plants would pay for themselves over many times. There is every reason for this and the mining interests of our country demand that such should be done.

The recent mining conference on the part of these interests in Ontario should result in a more satisfactory state of affairs in that province and result in

SMALL AUTOMATIC WORK.

IT is nothing short of marvellous the way automatic machinery is being designed and manipulated to turn out the finest and most accurate work demanded. Within the past month there came to the writer's notice a piece of work done on a Brown & Sharpe automatic machine that for smallness of size and accuracy has probably not heretofore been paralleled. It was a watch pinion spindle less than one-quarter inch in length. The body of the spindle was twelve one thousands of an inch in diameter. The most notable feature on this minute piece of work was the fact that it had a 60 deg. taper on either end, and, what is probably almost as remarkable, the fact that where cut it forms a perfect centre. This is obtained only by the extremely accurate tooling done, as well as by the fine regulation of the machines, as besides being tapered at either end the body is of two sizes, the larger extending about one-third of the length. It goes to illustrate the wonderful strides that have been made in machine tool adjustment and mechanism in recent years.

Rungs in the Ladder of Success

By The Editor.

EVERY man, young or middle-aged, in the possession of his faculties, should be keenly alive to the boundless scope and breadth of possibility that the moment offers. High up in the ladder the rungs are empty and await an occupant. The present holds out for you what no other decade could near approach.

Do you realize the fact?

A brief reflection would make this a conviction and, going further, quicken it into action.

Possibly not the success of the millionaire nor the statesman may be yours, but surely the real, genuine, satisfying success, the result of honest and well-directed effort, awaits you. This is obtained by making the most of one's self It means to those who have not made the attempt an enjoyment in being hitherto unknown.

For a New Year's resolution along the line of things that go to make success, let us suggest some reflection on the subject of the nobility of labor, having higher ideals, being confident, determined, persevering, industrious and enthusiastic. With these as an incentive no man can hold you back.

Nobility of Labor.

The mechanic is the great producer of the day. He is daily adding to the wealth of the world and should be proud of the fact. When a man reaches the state when he no longer works with his hands and belittles honest toil, he occupies a ridiculous position. He has forgotten that he is dependent upon the men who work for any measure of comfort he may enjoy. Suppose all the mechanics in the world were to stop work. How long would the wheels of commerce or industry revolve? Not many hours. Let every mechanic hold up his head and look the whole world in the face, feeling that he is an important and indispensable factor in the commonwealth. The writer knows the call of the 7 o'clock whistle, the clink of the time check and the line-up on pay day, and is glad of it.

Ideals.

No one has yet climbed higher than his ideal. No one ever shall. If you have not accomplished what you feel you might have, all the more reason for aspiring. If you are satisfied, then it is time to take Dr. Osler's prescription, whether you be twenty or three-score and ten. Look at the example of Richard Arkwright, the inventor of the spinning machine, and take heart. At the age of fifty he set to work to learn English grammar, writing and spelling, working often from four in the morning until nine at night. Was he justified? See the result. Eighteen years later he was at the head of many manufactories, had risen to the position of high sheriff of Derbyshire and shortly after was knighted by George III.

With no ideal beyond the daily round, one is as the miner with his torch extinguished, groping in the dark and unable to accomplish anything. If any of us have been living in the quarry-slave realm of thought, let us rise above it with all the strength of mind and body that we possess.

Confidence.

More perhaps than any requirable attribute that engenders success, confidence in one's ability to achieve is necessary. This, coupled with a fair amount of assurance, has caused many a young man to climb the ladder when his equally capable companion has failed. Meekness is misunderstood for weakness and a lack of confidence is the forerunner of failure. Be confident.

Determination.

Despondency begets madness, but determination is the key-note of accomplishment. How the world stands by for the determined man! He is the great explorer or navigator, the successful general or the powerful captain of industry. This is the attribute that made a Napoleon and a Wellington, and due to this the victorious Japs achieved so much. A determined man is a tower of strength. Be, therefore, determined.

Perseverance.

History's pages are filled with the records of men winning their laurels through sheer perseverance. It is not necessary to go beyond the realm of the mechanical world to find striking examples. George Stephenson spent fifteen years working on the improvement of his locomotive before meeting with his triumph at Reinhill. Another shining light in this direction was James Watt. The latter would not acknowledge defeat and after 30 years of investigation and toil he brought the steam engine to mechanical perfection. Let us keep these examples before us when our courage lags or our ardor cools, and resolve, as they well must have, neither relenting nor hesitating until we have improved our present position. Persevere.

Industry.

Well directed industry brings its own reward. Unfortunately much individual industry is misdirected and unproductive. Patient plodding application without the accompaniment of thought never brings a person to an exalted position. On the other hand, however bright the mind or clear the conception, the lack of industry is fatal to success. Be industrious.

Enthusiasm.

Enthusiasm is one of the hardest qualities to cultivate and maintain. It is one of the least common. The enthusiastic man leads. He is a moulder of opinion. He is a factor in the community and in the workshop. He commands attention. He is influential. He rises and progresses. He soars above his fellows. He is a marked man. Many people shrink from being enthusiastic for fear of attracting attention. If you are on the right track, however, every throb of enthusiasm opens the channel to higher things and to a position where one's abilities have fuller scope. Cultivate enthusiasm.

THOSE WHO FAIL.

It is ofttimes true that those who seem to fail are indeed more successful than those with whom all things appear to go well. It is not always the people whose names are on everybody's lips and who get frequent mention in the newspapers who are doing the most good; ofttimes those of whom little is heard, who work away in quiet and obscurity, are doing more to bless the world than those who seem so conspicuous. A writer tells of passing through a meadow and finding the air full of fragrance. Yet he saw no flowers and wondered whence the fragrance came. In his quest he found that beneath the tall, showy grass multitudes of little lowly flowers were growing, hidden away out of sight, yet pouring forth sweet odors. It is often the lowly lives that do the most to sweeten the world. —Ex.

Designing a Molding Machine

By T. C. Robertson.*

THE development of the molding, together with the flooring machine, has contributed more towards the rapid construction of buildings, than, perhaps, any other feature in the house building line.

The combination of molding members now used in producing massive designs and beautiful effect, calls not only for a large combination of knives upon the molding machine, but draws largely upon the ingenuity and resources of the operator. It is not enough that the operator should be a mechanic and somewhat of an artist, but must have some knowledge of the construction of the machine he is running, so that the purpose in the mind of the designer may be carried out and the best results obtained.

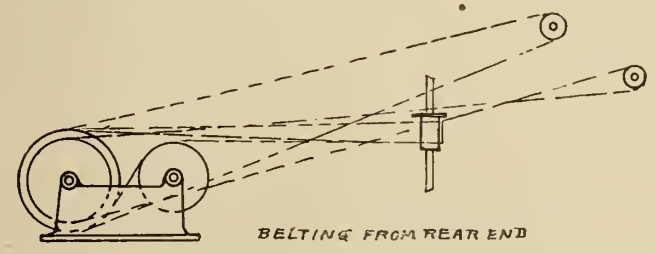
Many claims are put forward by the various makers, but the main difference between machines of different designs is one of convenience rather than of principle. During the years in which the molder was in process of evolution many builders in aiming at cheapness built their machines too light, having lost sight of the fact that to lighten the parts reduces its factor of efficiency. Experience of later years proves that high speed machines require weight to impart solidity and permanency, thus producing a higher grade of work. Another important factor in the building of this machine is the many improvements calculated to facilitate the work. This has become imperative, owing to the demand for a great variety of work, calling for rapid adjustment and the greatest convenience in operation.

A mistake frequently made by many machine builders is the enforced use of many wrenches. In putting on time-saving appliances the manufacturer will spare no expense to have bolt heads and nuts used many times in a day, as near one size as possible, so that the whole range of adjustment may be covered by as few wrenches as possible. Another means of saving time which has recently been adopted by builders is the substitution of hand wheels for wrenches, by which not only is quicker adjustment attained, but much twisting off of bolt heads and stripping of threads is avoided. The bolt threads of all adjustments should be kept oiled and friction surfaces kept clean, which will not only prolong their life, but assure more satisfaction in every way. Wrenches should be case-hardened, particularly those that are much used, as they will soon be compressed out of shape.

If possible all bearings should have cap screws of same size, and a socket wrench provided to fit them; in fact all set and cap screws should be as uniform as possible, so that the number of wrenches be limited.

The several adjustments which govern the top and bottom cutter heads, as well as the side heads, have received a good deal of attention by designers. All these movements should be made from working side of machine if possible. The side heads should, of course, be attached to bed or table, so that in raising or lowering they may always maintain the same relation to each other. They should, also, have both lateral and vertical adjustment, as well as tilting motion.

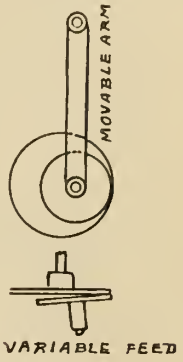
Pressure bars and pressure shoes employed in keeping material firmly upon table while cutter heads are in operation, have of late been remodelled and made more effective. They should be so constructed as to straighten as far as possible and hold firmly stock which may be more or less warped. For convenience in getting at cutter heads, it is better to have them so designed as to swing entirely out of working position.



BELTING FROM REAR END

Much has been said and written of late concerning position of top and bottom cutter heads in relation to finish of stock. Many contend that the best results are obtained by finishing stock pattern side up; others contend for finishing pattern side down. Both sides have strong advocates, and in order to satisfy customers manufacturers are building them both ways. In some instances molding machines are built with three cutter heads, besides side heads, one before and one behind centre top head, which enables operator to choose either method of finish.

An important feature of the molding machine is an improved feed of friction design, which of late has found strong advocates among mill men. This consists of two disks with faces placed opposite each other, the one perpendicular and placed upon driving shaft, the other with face oblique and movable by suitable mechanism across face of perpendicular one. In applying this method of drive care must be taken to have sufficient speed upon driver, so that plenty of power is transmitted to driven, and hence to feed rolls. A controlling lever convenient to operator enables him to vary feed instantly, without stopping machine. If friction disks are large a wide range of feed can be obtained.



VARIABLE FEED

The belting of molding machines has recently undergone changes similar to methods employed in surfacing machines. The placing of countershaft at rear end and separate from machine leaves space in front entirely free for stock and operator, besides giving any length of belts required. Objections may be raised to this method owing to countershaft being in the way of finished stock being delivered from machine, but this can be easily overcome by placing cover over pulleys directly in line with bed of machine.

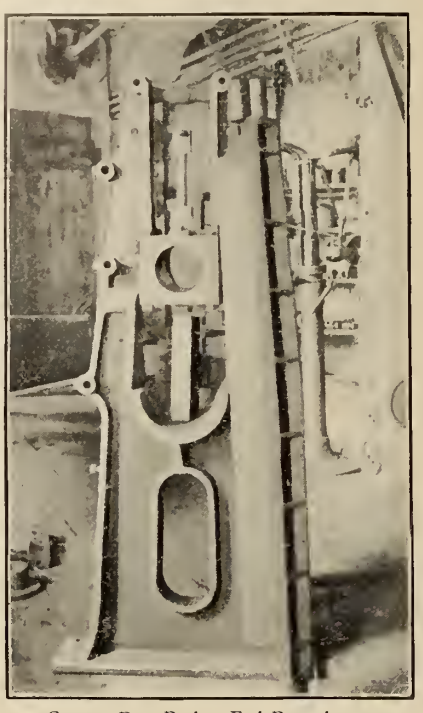
Much might be written concerning the minor but still important details of molding machine construction. Experience shows that too much care cannot be taken to insure durability, perfect alignment, perfect balance of cutter heads, tight babbit in bearings, in short every precaution taken to satisfy the most exacting operator.

* Chief Draughtsman, MacGregor-Gourley Co., Limited, Galt, Ont.

Burning Expensive Parts Together

By Edwin Krug.

QUITE recently a large housing and scraping bar for a huge paper machine for the Bird Paper Co., now locating in Hamilton, was broken in unloading same from the cars, through the cause of a faulty tackle giving way and letting the parts fall several feet from an incline they were being let down. The housing shown in the accompanying photograph was broken at the mark shown, and the end broken off the scraping bar. To replace these parts quickly was quite a pressing matter. An accurate repair was imperative, if made, and the machine coming from the Eastern States, to put in a new one meant a very expensive undertaking, as the housing was planed on the base and in and outside, drilled accurately to fit the different levers, brackets, etc., besides the lower being babbitted a given height from the base to suit a mammoth ground roll 16 inches in diameter between bearings, and shouldered down at the bearings to 9 inches and about 8 feet long. The upper roll was about half the diameter driven at a ratio of 2 to 1 by spur gears, and was supported by two large babbitted boxes, gibbed sides to fit snug on the insides and gibbed to fit sidewise so as there would be no lateral motion in elevating and lowering, which was done by hand nuts and levers, fulcrumed from the housing to a standard fastened to the upper half of the boxes, and long elevating screws, the hand nuts to lock same when the required height was reached. The large rolls were in the housings when they fell, and this section including a subsidiary roll and suitable brackets to support it weighed six tons. nine hundred pounds. Mr. Geo. Coombes, of the well known firm of Kerr & Coombes Foundry Co., and the writer were called in consultation on the subject, and after looking over the ground, which, by the way, was over a considerable part of the machine, we decided it could be burnt together successfully and to this end we dismantled the machine and brought the offending parts to the foundry. Probably the average reader will not understand this operation, and a little insight into it may



Scraper Bar, Broken End Burned on.

prove a benefit. Usually the parts to be burned are fastened together securely, then bedded in the sand, and a place is left open like a gate above the broken place to pour in the molten metal and enough iron poured on the part or parts to be burned to burn the new section in, and a gutter is dug to let the molten mass run into until the required amount, which depends on the size of the casting, has been poured in. In this case about six hundred pounds were required to burn in the new section and a rib was left to help strengthen the same. In preparing this casting for the foundry we were unusually fortunate, no extra holes being required to be put in. The sides of the housing had large cores through, and one side of the housing was still intact, then we had the gibbed box referred to previously to space us accurately, and put long bolts through the cored places and clamped each side of the bearing, testing same from end to end to make sure the two were perfectly parallel. The scraper box, the broken end of which is shown in photo, was burned on also, but a new piece was made and burned on as the end was turned and bored to swing on a centre stud and must be the correct distance between the shoulders, and the break was exactly at the square shoulder. To burn on the old piece and have same come true a nice faced shoulder was out of the question, so a pattern and casting for a new end was made long and large enough to permit being laid out true with the scraper edge and face. Then for material on the shoulder the bar was bedded in the sand the usual way and moved back after taking the impression one-quarter inch, so when burned on the shoulder was then faced correct width, the new end turned up and not one blemish was noticeable, the new piece standing roughing off 1-2 by 1-32nd inch, and then finished, steady-rested and this heavy piece unequalling balanced swung and bored to required size and depth. This foundry makes a specialty of burning pieces together and is remarkably successful in this line, having burnt thousands of dollars' worth of parts together, which have stood the strains they are subjected to for many years and are still doing so.

Making Cold Drawn Shafting

LESS than a year ago no cold-drawn shafting was made in Canada. Now there are in Canada two large plants, one already manufacturing and the other rapidly approaching that position. The requirements of any factory always constitute with it a large amount of shafting, and upon this and its proper adjustment and bearings depends to considerable extent the power economy of operating the plant. Very special machinery is required for the manufacture of cold-drawn shafting, and the equipment seen in the plant of the Union Drawn Steel Co., at Hamilton, is a revelation to any one not conversant with this line of manufacture. Probably in no other line of metal working machinery are such long beds required nor such lengthy and ponderous driving gears.

The raw material of the cold-drawn steel company's plant is the finished product of the rolling mills. The first operation consists of placing the bars to be drawn in a bath, where they are thoroughly cleaned. The operations are few but all important. The material is then taken to one of the heavy drawing machines and drawn through a solid die of the exact size correct to 2-1,000 of an inch. From this machine it passes through a specially designed straightening machine, and from there to the cutting-off machine, where it is cut the exact length ordered. When the length has been cut off as desired every bar is tested on live rollers the same as if it were running on centres. Any crooks

or bends that may have existed in the bar after leaving the cutting-off machine are thus removed.

In addition to the drawing machines, where any size of shaft up to three inches may be drawn, a lathe has been installed to turn shafting from 3 to 9 inches, with no limit to the length except, of course, that of the building, which is by no means of small proportion. This is the only style of machine in existence that finishes the shaft complete and ready for use after coming from the rolling mill.

It might be presumed from this that the equipment of a cold drawn shafting plant is small, but this is not the case. As the special machines required are all of enormous size, and the multiplicity of gears and belting required in running these, from the large induction motors that have been installed, is bewildering on first sight. As a particular favor and departure from usual custom, the representative of Canadian Machinery was shown through the plant mentioned, and is indebted to Mr. A. J. McMahon for the interesting insight into the method of manufacturing cold drawn shafting, whose manufacture requires not only machines of enormous power but of remarkable accuracy.

Machine Shop Costs

By G. C. KEITH.

IN connection with these articles on costs in the machine shop, the article on "The General System of Cost Keeping," in April Canadian Machinery, should be read as an introduction. These articles will contain a practical system of machine shop or factory cost keeping, and other information as costs, efficiency, and the compiling of information for the use of the manufacturer and superintendent.

It is only recently that practical and complete cost systems have been devised for computing machine shop and factory costs. In the most useful system everything must be condensed and classified and details brought to the notice of the superintendent in such a manner that with a glance he can obtain the required information and see how the work is progressing in the shop.

Many manufacturers have been content to take their selling price from others. Even in this present age producers may be found who count their selling price from the rhyme of the shop poet:

"Man and tools, shop and power,
Come to fifty cents an hour."

But these latter are not apt to be the successful manufacturers. In this age of competition each individual manufacturer must know where he stands. It does not do for him to accept other manufacturers' selling prices. His costs may not be the same. He may not have bought at the same markets, and market prices are liable to change. The supply may not be equal to the demand and there will be a rise in prices or the opposite may occur. The market may be flooded and the price will decrease. The same may be equally true of the labor market, and the price of labor may go up or down, depending on the supply and demand. It is therefore essential to a business man's success to establish a system of costs that will show him in what shape his work stands and where he is financially at any time.

The man who is making a success at farming to-day is the one who knows where he stands, how much the running of the farm is costing him, and to what his receipts amount. His cost system may be a single set of books showing moneys paid out and received. If he wishes to sell his farm he can then show the purchaser how his farm has paid, and why the price should be $60 or $85 an acre. It does not do for a farmer to know that a disc is worth $45, or another machine worth $125. It does not do for him to know that cows sell for $40 each, or horses for $175. He must know his total outlay and his income. It will not do for him to make his entries on the side of the barn, showing the sale of eggs, grain, hay and cattle. When he comes to look at his marks he finds them mixed and he does not know where he stands. He must have some system about it, and the simpler it is the better for the farmer, but it must be complete. So it is in the factory. It doesn't do for a manufacturer to know that scrap iron is worth $1.20 per 100 lbs., or a certain machine in the shop cost $75 or $575. He must be able to tell the cost of the machine or engine he is manufacturing. He must be able to tell what profits he is making, whether a certain lathe or planer or other machine is a profit or an expense to him. If an expense he can investigate and have the cause removed or the machine replaced. In purchasing a machine there must be a man at the head of affairs who knows whether a milling machine or a slotter, a boring mill or a drill, a shaper or a planer will be the most economical and profitable machine for the work to be done. It will not do to purchase a milling machine to cut out keyways and have it in use six months in the year if by buying a slotter not only the keyways may be cut but also other work may be accomplished which will keep it in use the year round. Circumstances might arise, however, when the milling machine might be more economical, for it might be used for milling articles that could not be planed.

In machine shop costs there are three divisions: (1) labor; (2) material; (3) factory expenses. The first is divided into two classes: (1) producers; (2) non-producers. The producers are the only source of income, and include only those who are working on articles to be sold. All other employes—the president, manager, superintendent, foremen, office staff, draughtsmen, tool and pattern makers and watchmen—are non-producers. They do not bring any direct income to the establishment, but are just as necessary to the success of a business as the producers. The factory could not be run without them, and if it could they would be quickly dispensed with, as the close competition of to-day would demand it. But the success of the factory depends on the personality of these men and the system they employ. The application of modern ideas to business gives more chances for a manufacturer to be a success. In determining costs, system simplifies everything, and the manufacturer who recognizes this has taken a long step towards success. In a cost system for a machine shop there are many branches, but if the shop be too small to require the number of men the offices may be successfully combined.

Under material is included raw materials for construction and plant supplies, such as reamers, taps, dies, drills, belts and belt lacing, emery, files, hammers, waste and oil. There are many other expenses which come under the third division—insurance, rent or taxes, depreciation, repairs to machinery and building, water, scrap pile, i.e., spoiled work, fuel, light, telephone, stationery, postage, telegrams, traveling expenses, freight and express.

The raw materials and factory supplies are taken care of by the stock clerk and his assistants. The productive labor is looked after by the timekeeper.

(To be continued.)

BOOK REVIEWS

Modern Turbine Practice and Water Power Plants, by John Wolf Thurso. New York: D. Van Nostrand Co.; 244 pages; $4.00 net.

The author has presented a work which at the present time will be appreciated particularly by Canadian engineers whose attention is being drawn to hydraulic power developments. In the preface it is stated that the object is to present the subject in a form adapted to the work of the hydraulic engineer engaged in general construction and not to assist the expert turbine designer. The reader is impressed with the author's familiarity with his subject and is indebted to him for a large fund of information that has not heretofore been available to the English engineer.

The first two chapters of the book are devoted to a comparison of European and American practice in turbine construction. The severe arraignment of American design and construction is largely merited, but the author's attitude appears to be more hostile than sympathetic. His argument is that as the turbine equipment of the average plant represents only about 10 per cent. of the total expenditure, it is not economy to design the rest of the installation so as to enable a cheap wheel to be used. Those who are familiar with the present practice of picking out single wheels, pairs of wheels and other combinations from the tables in the catalogues of American makers, in an endeavor to meet their requirements as to speed and power, will appreciate the author's criticisms. The author's point that Holyoke tests are misleading when made on wheels that are to be used under a high head, is well taken.

The chapters on "Classification of Turbines" and "Modern Turbine Types and Their Construction," are probably the most valuable in the book. In them recent installations in Europe and America of high-class turbines under various conditions are described and illustrated. Unfortunately, the dimensions on the drawings are in metric units. There are chapters on "Accessories to Turbines" and "Governors and Speed Regulation" that are of value. The author has also included in his work as an appendix, the notable paper on "Speed Regulation in Plants Driven by Water Power," presented by Mr. Allan V. Garratt before the A. I. of E. E. in 1899.

Chapter IV. treats of steam turbine practice.

The arrangement of the work will admit of improvement. In the first part of the book the development of the subject of turbine practice is subordinated to a criticism of American practice, and much of the matter in the first two chapters has to be repeated and enlarged upon in the third and fifth chapters. Nomenclature in hydraulic work is very confusing and as a step in the right direction, the author prefixes a list of terms and symbols.

"Modern Turbine Practice" contains much information of value to the hydraulic engineer and is probably the most valuable work available to the English reader.

Gas, Gasoline and Oil Engines, including Gas Producer Plants, by Gardner D. Hiscox, M.E., author of Mechanical Movements, Compressed Air, etc; fully illustrated by 500 engravings and diagrams contains 550 pages; price, $2.50 net. New York: Norman W. Henley Publishing Co.

The books of Mr. Hiscox need no introduction to the American or Canadian readers of technical literature, as his different editions are well known as standard authorities on the lines they cover. This volume is the 15th edition, having been revised, enlarged and reset, is the only complete American book on the subject for gas engine owners, gas engineers, and intending purchasers of gas engines. It treats fully the construction, installation, operation and maintenance of gas, gasoline, kerosene, and crude petroleum engines. It deals with the theory of gas, gasoline and oil engines as designed and manufactured in the United States, leaving out for the most part British and continenal practice, where the gas engine has received much more attention than in America. Little is known, as far as actual practice is concerned, of producer and suction gases on this continent, so that the information given by Mr. Hiscox in this work will be thoroughly appreciated. A commendable feature is the insertion of the rules and regulations of the Board of Fire Underwriters in regard to the installation and management of gasoline motors. A useful directory appears, covering the entire list of manufacturers of gas and oil engines in the United States and Canada. Besides which, is a full list of the patents issued on gas, gasoline and oil engines and their adjuncts from 1875 to date. Mr. Hiscox is to be congratulated on this volume, covering, as it does, in such a complete manner, the subject of gas, gasoline and oil engines in America.

Electrical Pocket Book and Diary. The "Practical Engineer's" Electrical Pocket Book and Diary for 1906. Manchester Technical Publishing Co., Limited. Price, 1s. 6d net.

A handsome little leather bound volume, gilt, with diary on ruled section paper, occupying about a tenth part of the whole. This book would be appreciated by all interested in electrical engineering or electrical practice of any kind. It serves as a ready reference that may be carried about without any inconvenience, being but 3 1-4 x 5 1-2 inches. The information and data pages number 440, in which are included tables, explanation of terms, formulae and descriptive matter bearing on the different branches of the art. Every electrician and engineer would find this a valuable companion.

Electrical Instruments and Testing. How to use the voltimeter, ammeter, galvinometer, potentimeter, ohmmeter, nad the Wheatstone Bridge, by Norman H. Schneider, New York, Spon & Chamberlain, 133 Liberty street, 198 pages, price $1.

In this volume the author has realized the fact that to make a treatise of this kind most effective examples of problems dealing with the subject at hand should be given. This course has been followed throughout, and adds greatly to the value of the book. The different instruments are described and dealt with in a practical manner, numerous illustrations and diagrams being used throughout, and which should commend itself to everyone having occasion to use electrical instruments, and on that account should meet with a ready reception at the hands of electrical engineers, electricians and engineering students. At the commencement the simple galvinometer is explained in an easily understood manner, after which different forms of galvinometers are dealt with, together with their practical application. The other instruments are described in turn, together with very clear diagrams of connections for making different tests. As mentioned before, the examples and problems in this book add materially to the value of it, and render it of greater practical value to those interested in electrical measuring instruments.

Reviews of the Month

OPINIONS AND STUDIES WORTH NOTING

PERPETUAL MOTION MACHINES.

IN the enlightened age in which we are living, one would almost expect that the idea of "perpetual motion" had ceased to occupy the minds of men, and that the hope of ever obtaining a machine which, once set in motion, would go forever, had been abandoned. This, however, is by no means the case, for inventors are still to be found who exercise their ingenuity in this direction. The records of the British Patent Office show that, as recently as the years 1901, 1902 and 1903, there were, respectively, 13, 10 and 9 applications for patents relating to perpetual motion. From the year 1617, the date of the earliest patent, to the present time, the subject has received a fair share of attention, the number of applications between the years 1617 and 1903 being over 600, of which only 25 have a date prior to 1855.

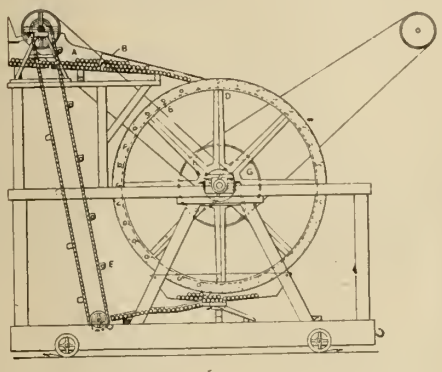


Fig. 1.

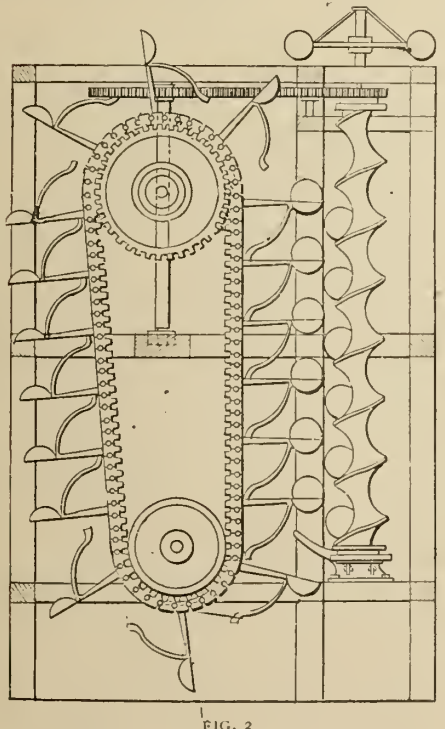


FIG. 2

In the many projects and schemes for obtaining perpetual motion, use is made chiefly of the force of gravity, loss of equilibrium, specific gravity of floats and weights immersed in water or other liquid, ascension of receptacles inflated with air or gas under water, compression and subsequent expansion of gases, and of the surface tension of liquids. That many of the inventors are perfectly sanguine of success, is demonstrated by the fact, almost humorous at times, that in many cases they provide brakes to stop their machines when necessary, or to prevent any dangerous increase of speed.

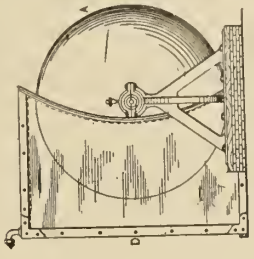


Fig. 3.

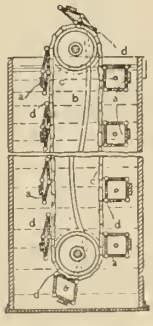


Fig. 4.

One of the commonest forms of perpetual motion machine is that in which a wheel (D), Fig 1, resembling a water-wheel, has cups or buckets on its periphery, each large enough to hold a wooden or metal ball (B). The cups on the descending side of the wheel are fed with balls from an incline (A), while those on the ascending side are empty, the difference in weight on the two sides being stated to produce rotation of the wheel. The balls roll out of the cups as they arrive at the lowest point of the wheel, and are lifted back to the incline by means of cups (E) on an endless belt driven from the wheel (D.) A pulley (G) and a belt are shown by which "motive power may be taken from the engine."

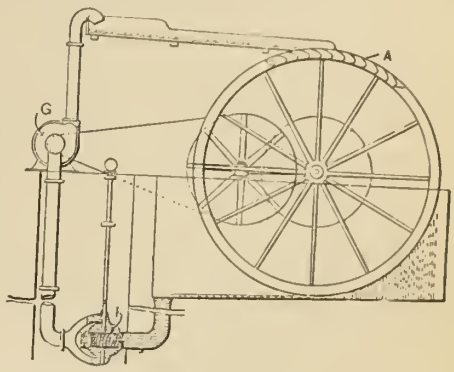


Fig. 5.

In a similar device, shown in Fig. 2, the balls fall into cups carried by an endless band. At the bottom, the balls are arrested by two horns, and are raised to the top again by a screw conveyor driven by spur gearing from the upper pulley over which the endless belt travels, a half-tube of guide rods being provided to make the balls rise vertically as the screw rotates.

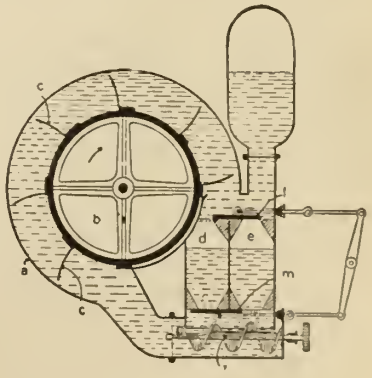


Fig. 6.

The buoyant motor, in which use is made of objects rising in liquids, has various forms. According to one, a

wheel with floats on its periphery, or a sphere or cylinder (A). Fig. 3 is mounted so that one half of it is in tank (D) of water while the other half is outside the tank, or in a vacuum chamber. The upward pressure of the water on the part immersed in it produces rotation. If there is any difficulty about a fluid-tight joint where the wheel passes from the tank to the atmosphere, the whole wheel may be immersed in the water, the buckets or floats on the ascending half being extended or made buoyant, while those on the descending half are closed. An example of this is shown in Fig. 4. The floats (a) on the endless chain (c) are made with hinged frames and are loaded so as to collapse when descending. The stops (d) prevent them from collapsing when ascending. The floats may be connected in pairs by hose pipes (b) that air may pass from one float to another.

An inventor proposes to combine the water-wheel, turbine and centrifugal

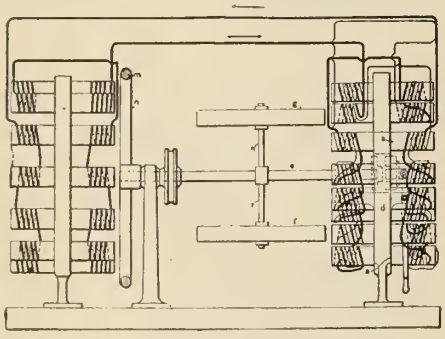


Fig. 7.

pump as shown in Fig. 5. The water, after leaving the wheel (A), drives the turbine (I), and the pump (G) is driven from the wheel (A) to raise the water again to the top of the wheel. The power is taken both from the wheel and the turbine.

An ingenious device, invented as recently as 1900, is shown in Fig 6. Here the drum (b) with folding vanes (c) is driven by water flowing alternately into the chambers (d) and (e), a vacuum being produced in the chambers by a screw (t). Valves (l) and (m), worked simultaneously open and close the chambers, one chamber being open at the top, while the other is open at the bottom, and vice versa.

The magnetic motor is another form of perpetual motion machine. A good example, invented in 1894, is shown in Fig. 7. A series of permanent magnets (a) are mounted on a fixed frame (d) so as to form two semi-circles eccentric to the shaft (e), and the like poles of the magnets face one way.

Two permanent magnets (g) are mounted on arms (h) on the shaft, their similar poles facing toward the magnets (a). The action of the magnets (a) causes the magnets (g) to rotate. The magnetization of the magnets (a) is increased by means of the windings shown, current being generated in the coils by means of an armature (n). The armature is carried by a wheel (m) on the shaft (e), which rotates in front of the magnets (i).

The motor shown in Fig. 8 should be particularly interesting to motor cyclists, for all expense in connection with petrol, electricity and other sources of power is thereby removed, the weight of the rider on the saddle places a pressure on the water on the hollow bar (D). This water passes through nozzles and drives a turbine wheel (B); it then passes to a chamber (G), from which it is pumped back to the bar (D) by pumps (H). The pumps are driven from the wheel (B) through the spur gearing shown, the vertical spindle (M) having a cam groove into which blocks on each pump rod engage. The cycle is driven by a belted connection with the turbine.

From the foregoing examples, it is evident that much ingenuity and thought have been spent upon the subject of perpetual motion, ad that in many cases it would be foolish to suppose that the inventors are cranks, on the contrary, the care and thought as to principle and detail in many of the inventions, demonstrate that many men still cling to the idea that perpetual motion is possible, and that they themselves are successfully solving the problem.— Cassier's Magazine.

OUR HERITAGE OF THE MECHANICAL ARTS.

NO certain date is attached to the most important event in the history of the mechanical arts, the discovery of iron. Iron is mentioned in the Vedas, the Upanishads, the Bible, and the Iliad; it appears in the fragments of Sanchoniathon; it is delineated upon the Egyptian monuments assigned to Thothmes III.; nevertheless the date of its discovery is a problem which is not yet satisfactorily solved. The secret of smelting iron ores and converting them into metal was certainly discovered by somebody, somewhere, and at some remote time, but we know not where, when, nor by whom. When this discovery did occur, at all events when it became publicly known and commonly put into practice, it must have exercised as profound an influence upon the ancient world as that of gunpowder and firearms has upon the modern. Iron not only armed the people who discovered it with superior offensive weapons; it enabled them to build ramparts of stone, to pierce the rocks for silver, copper, lead, and to fabricate nearly all those implements, tools and devices which distinguish the mechanical arts. The name chalybo, for iron, points to Chalybia, and of Damas, for steel, to Damas, or as we write it, Damascus. In the vicinity of both of these districts, very ancient mines have been discovered, and in the former district, at Ayazinn, Mr. Ramsay found rock sepulchres, guarded by gigantic carved lions, and a large chapel, all carved out of the solid rock, which could only have been executed with steel tools. Colonel Leake found at Nacolaeia, in the Sargarius Valley, a royal tomb in the form of a temple carved in the solid rock, with a Phrygian inscription by Attes, dedicated to Midas, while near by were the remains

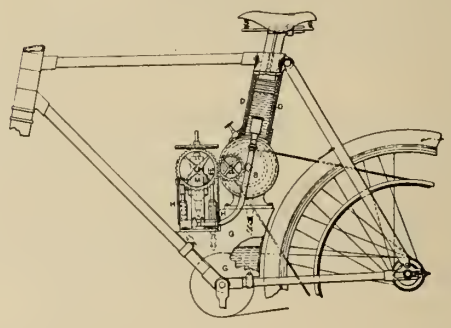


Fig. 8.

of a city, which from its great extent is supposed to have been the capital of the Sangarians, or Maryandians.

In the age assigned to the judges of Israel, about the 12th century, B.C., Jabin, the king of Canaan, or Phoenicia, who dwelt at Hazor, about 60 miles southwest of Damascus, is said to have possessed 900 chariots of iron. (Judges iv., 3) "Can one break iron from the north?" (Jer. xv., 12) and "I will break the bar of Damascus" (Amos i., 5) are passages which were probably written several centuries before our era, and may refer to a still more remote period; while they evidently point to the vicinity of Damascus as a well-known iron centre.

Could we accept these indications for a certain guide, the advent of iron, at least so far as the western world is concerned, might be fixed at about the twelfth century before our era. Both iron and steel were certainly very scarce in the west at the periods mentioned. Homer, tenth century, mentions pole-axes, shipwrights' tools, plowshares, sheep hooks, and chariot

wheels in the Troad, yet in Lacedaemonia, in the time of Lycurgus, ninth century, iron was still so valuable that he employed it as a material for money. —The Scientific American.

ELECTRIC REFRIGERATION.

EVER since the perfection of the cold storage plant, money and brains have been expended in producing an iceless refrigerator. It was generally conceded that there was a demand on the part of dairymen, soda fountain proprietors, saloon keepers, butchers, and grocerymen for something that would make them independent of the iceman, and this seems at last to have been accomplished. Besides being a great convenience, the new refrigerator has a number of other recommendations, notably its cleanliness. Because of the great amount of moisture in the interior of the refrigerator, and because of the material usually stored within, the walls tend to become foul unless cleaned with scrupulous care at frequent intervals. This condition is brought about all the more quickly where the ice is not pure. Moreover, the charging of the ice receptacle every day is a nuisance. All this is done away with by means of electric refrigeration.

The electric refrigerator is a self-contained and automatic cold storage plant in a small way. It almost takes care of itself. The switch controlling the electric current is the only part that must be manipulated.

A refrigerator of this kind has been in operation for some time as an experiment in a Philadelphia grocery store. When the store is opened in the morning, the current is turned on and remains so during the day. Although the box is being constantly opened and closed, the temperature is maintained at 34 degrees. About the best temperature obtainable by the ordinary method of icing is 40 to 42 degrees. When the store is closed for the night the current is shut off, and the temperature remains constant all night. The difference shown by the mercury between the closing and opening hours is never more than one degree. During all this time no operating expenses whatever have been incurred.

The largest soda fountain in Philadelphia has been in operation for several months, and the materials drawn therefrom have been uniformly several degrees colder than could be secured with the use of shaved ice, and yet no ice has been used in it. A motor of one-half horse-power in the cellar operates a refriegrating plant, which not only keeps the fountain at a frigid temperature, but also does some additional work of a similar character in the cellar.

The iceless refrigerator is much the same in appearance as any large refrigerator. In a compartment at one end a motor and all the necessary compressors and other paraphernalia are contained. The place usually occupied by the ice is given over to a tank containing brine, which is the means of cooling the interior of the refrigerator. The principle is identical with that of the large refrigerating establishments, but this is the first time that the system has been reduced to an automatic basis. No expert knowledge of either electricity or refrigeration is required in order to operate one of these outfits.

THE HEROISM OF INDUSTRY.

HEROES of the battlefield, and heroes of the sea! Of these, how frequently we hear — worthy often, yet often over-praised. But the heroes of peaceful industry in all the commoner walks of life—what of these? Of the farmer delving out yonder in pasture and plow-land; of the swinger of the hammer in the forge; of the builder under whose touch tower and temple spring into proud proportion? What of these world-wide common workers whose ceaseless, uncomplaining toil quickens the pulse and animates the life of nations? Who will sing their paean—who has written their history and renown?

Toil, the Creator.

We have heard among the idlers who float on the surface of society, contemptuous flings at those whose heritage is toil. They sneer at the hard and horny hand of labor; but they forget that of all that is useful, luxurious, or beautiful on earth, toil has been the creator; that from the marble mansion to the kid gloves of the tailor's most exquisite walking sign, all has been wrought out by human industry. It is the toil of swarthy hands, thou pitiful idler and sneerer—just such hands as thou see'st daily along the curb or in the crowded car—that has reared empires in the Old, and planted republics in the wilderness of the New World; that has hewn the rock in the quarry, built the "miracles in stone" that are the shrines and monuments of nations, and laid the foundations of all great modern industries; that has achieved whatever fame belongs to genius, with the sculptor's chisel, the painter's pencil, and the poet's or scholar's pen; that has winged the ocean with white sails, and exchanged the products of every clime; that has measured the circuits of the stars, and plumed the lightnings to be the swift-winged messengers of man's bidding.

Idleness a Crime.

Industry! Why, man of idleness, this is what fed you pap, rocked your cradle, and nursed your pampered life. Without it, the woven silk and wool on your back would still be in the silk worm's nest or in the fleeces of the shepherd's fold. For the meanest thing that ministers to human want, save the air of heaven, man is indebted to toil. It is only drones who toil not, infesting the hives of industry with corruption and decay. The lords of the earth—if they but knew it—are the men who do things, who can build up or cast down at will, and who can retort to the sneer of the "soft-handed" by pointing to their trophies wherever art, science, civilization and humanity are known. Work on, man of toil! Your royalty is yet to be acknowledged, as industry rises toward the highest throne of power. — Technical World.

TIME ELEMENT IN THE REPAIR SHOP.

ALTHOUGH repair shop economy has been much discussed during the last few years, there is still need of emphasizing the importance of an efficient maintenance organization in street railway shops. In some cases a narrow policy is still pursued by the management as to the purchase of improved appliances and the payment of attractive wages in the mechanical department; in others the failure to turn published experience to the best account is the result of the inability of the operating department to spare rolling stock for service long enough for thorough inspections and light repairs. Under such conditions the time required for the execution of repairs is doubly worth reducing. The key to the whole problem is good organization of labor and machinery. Motor-driven tools and high-speed steels are important factors in the repair process carried on under "forced draft" conditions, but unless the saving of time at the machine tool is to be lost elsewhere, it is necessary to investigate the repair shop problem in the same manner as do factory managers contemplating the installation of the most modern processes—processes which require one to use a stop watch and note book from the time the raw material enters the establishment until the finished product leaves the works to fully appreciate what is being done. For example, the vertical hoist is a most useful piece of machinery, but if the shop is deficient in facilities for horizontal translation, the time saved amounts to very little. Runways along which motors, axles or other loads supported by power hoists can be freely moved should be liberally provided in the repair shop, and the track lay-out in new designs ought to require the shortest possible distances of handling between departments.—The Street Railway Review.

CASE HARDENING OF STEEL.

THE process of case hardening consists in bringing the steel or iron articles into contact with carbon in closed boxes or pots and raising them to the requisite temperature for a sufficient length of time; afterward the articles are reheated and cooled by quenching in oil or water. The furnace should be so constructed as to be capable of being raised to a full orange heat (1,000 degrees C), and maintained at that heat with great regularity. Neither the fuel nor the direct flame should come in contact with the charge, that is to say, the flames should uniformly impinge on the sides and roof of the muffle, thus heating the contents of the muffle by radiated and not by direct heat. The result is most economical in the matter of fuel. There should be a small peep hole in the door, with a cover plate; a hole 1½ inches in diameter is quite large enough.

Fig. 1 shows a small furnace costing about $175. There is an upper chamber in this furnace, and though this is not necessary for case hardening it may in a small works be found useful to have such a chamber and employ it, while case hardening is being done, for the insertion of any articles which require annealing. This will add only very slightly to the amount of fuel used. Generally speaking, coal is the fuel employed; but for large works, where a large number of furnaces are kept going, gas-fired furnaces should give every satisfaction. Hardening pots are made in both cast cast and wrought iron. The latter bear re-heating so many times that they are cheaper in the end. The pots should not be of too large dimensions, or there is great risk of articles in the middle of a charge not being cased to a sufficient depth. The pots should each have a plate lid fitting closely inside.

Perhaps in no part of the process have there been so many differences of method as in the question of the carbonizing material. The carbonizers in general use at the present day are animal charcoal, bones, and one or two other compositions sold under different names, and consisting of mixtures of carbonaceous matter and certain cyanides or nitrates. For very slight hardening cyanides alone are still found very useful, but no great depth of casing is ever attempted with these.

Details of the Process.

The carbonizer having been thoroughly dried and reduced to a fine powder, a layer of not less than 1½ inches in depth is placed in the hardening pot and well pressed down. Upon this are placed the articles to be hardened. Care must be taken to leave sufficient space all round each piece to prevent its touching the others or the walls of the pot. A space of 1½ inches should be sufficient. Another layer of carbonizer is then put in and well pressed down, taking care not to displace any of the articles already packed, continuing until the pot is nearly full, and then finishing off with another layer of 1½ inches at the top. The object in view must be to make the contents of the pot as compact as possible, consistent with a sufficiency of carbonizer in contact with the articles. The more solidly a pot is packed the more effectual is the exclusion of air. The lid is then put on and the joint all round well luted with clay. By the time the proper number of pots have been filled the furnace must have been raised steadily to the full working heat. According to my experience the proper heat for case hardening is 1,000 degrees C., or a full orange "heat color."

At the close of the carbonizing period the pot is withdrawn from the furnace and placed in a dry place, where it is allowed to become quite cold. It is then opened and the articles taken out and brushed over to remove all adhering matter. If the pot has been properly packed and luted up the articles should be quite white, or, at least, have only a slight film or bloom of a deep blue color, the denser and more inclined to redness is the surface the more perfect has been the packing and sealing of the pot.

The case hardened articles are now placed in a muffle furnace and steadily raised to a good cherry red (800 degrees C.), and then quenched in cold or tepid water or oil, according to the purpose of the articles required. They should remain in the cooling liquid until they are quite cold right through the body of the metal, thus completing the process.

Then we have to determine at what temperature we are to work the cementation part of the process, and to decide this there are several points to be strictly observed. (1.) The carbon in the case must be about 0.80 per cent. (2.) The case must neither be too high nor too thin. (3.) The temperature must not be so high as to overheat the mild centre. (4.) The core must be of the greatest possible strength.

Although I have given separate requirements, we must consider them altogether. A temperature of 1,000 degrees C., if continued to saturation, would yield a carbon percentage of about 2.5; but if interrupted at any stage short of saturation the skin would contain less carbon, and the centre still less, on account of the process of diffusion being still in progress. If we take two pieces of ⅝ inch diameter round mild steel and heat one of them with a carbonizer at a cherry red heat and the other at a bright orange heat for six hours; the first will be cased to a depth of about 1-32 inch and the other to a depth of nearly 1-16 inch, while the amount of carbon taken up will be about 0.50 and 0.80 per cent., respectively. So that, so far as regards the hardness of the skin, the piece cased at the higher temperature gives the best result. From this we learn that a temperature of 1,000 degrees C. will give us sufficient hardness of case.

We have next to find which temperature has the least hurtful effect on the mild steel core. Suppose, for example, we take three pieces, heating at 1,000, 1,300 and 1,500 degrees C., or full orange, white and bright white, respectively. We shall find that those at 1,000 and 1,500 degrees break very short and have lost nearly all their original tenacity, while that at 1,000 degrees appears tougher and altogether stronger than before.—Iron Age.

THE NATURE OF LIGHNING.

THE three institute papers on lightning protection, on which we comment below, serve to point the moral which we have drawn at divers times regarding the need of knowing more about lightning prior to trying to avert it upon scientific principles. It is clear enough from the papers that the lightning under consideration was a very variable thing, and that ways and means of circumventing it must likewise be variable. For example, the excellent results from horn arresters on the Shawinigan Falls line show clearly that under the circumstances found there the minor disturbances often grouped as static, cut little figure from the operative standpoint, and that the important thing was real lightning actually striking the system. On the other hand, Mr. Torchio's description of the precautions on station lines showed plainly a system of protection directed mainly against static and induced discharges. In order to attack the problem of lightning protection with some chance of success the nature of the phenomena needs to be studied exhaustively. We know in an approximate way that lightning is of the general nature of a condenser discharge between cloud and earth or between cloud and cloud. For a long time this by a false analogy led to the conclusion that lightning is, therefore, essentially a high frequency oscillatory discharge. But it is clear that the nature of the actual discharge depends on the amount of capacity concerned and on the resistance and reactance of the path. It is easy to see that these factors may assume values leading to so great damping that the discharge would be nearly or quite non-oscillatory, and even if it were oscillatory the capacity involved would probably correspond to very low frequency.—Electrical World and Engineer.

Construction and Improvement

General Construction *Contractors' Supplies*

THE GROWTH OF SKY-SCRAPERS.

CONSIDERABLE discussion has been aroused from time to time as to the possible limit in height of the modern sky-scraper. It is now proposed in New York to erect an office building 560 feet high, which is higher than the Washington monument in the nation's capital.

As yet Canada has had little experience with sky-scrapers. At the present time there is under construction on Yonge street, Toronto, a building by the Traders Bank that when completed will be the tallest in the British Empire. It is to be fifteen stories high, and will have room for 1,500 people. The elevators will have a run of 187 feet, the flag pole being 200 feet from the ground. At the present time a storey a week of structural steel is being erected at which 100 men are engaged. The steel used in this building will amount to 1,700 tons. As the steel is erected the concrete flooring is put in. Ten thousand barrels of Canadian cement will be used in the structure, and 2,000,000 bricks. The exterior will be of grey limestone similar to that of the Flat Iron building in New York. It is fireproof throughout, the only wood being the window sashes and frames. It is expected to have the masonry completed by Spring and the building ready to occupy on Dominion Day. Steam vacuum heating and ventilation system is being installed and the entire building wired for electric light.

First Concrete Sky-Scraper.

The first sky-scraper to be constructed of cement with cement walls has been completed in Cincinnati. An illustration is shown herewith of this building, which occupies an unique position in cement walled structure. It is of the same number of storeys as the Traders Bank building, of Toronto, and bears considerable resemblance to the latter, but the Toronto building presents a somewhat more handsome appearance.

ARTIFICIAL BRICK.

Recently a large factory has been established in British Columbia for the manufacture of artificial sandstone bricks for building purposes. It is a recent German invention, in which sand and quicklime are mixed together in certain proportions, the latter hydrated in a mold in which a vacdum is produced, and as there is no space for expansion of the lime of hydration, the compression of the material follows. The brick is further compressed in stamps of high pressure and than passed into steam boilers in which a current of steam is chemical combination of the sand and kept up for 8 or 10 hours, causing a lime and producing hydrosilicate of lime. The lime acts as a binding material or cement, uniting the particles of sand together and producing a brick of exceeding hardness and practically impervious to moisture.

The Patent Roofing Co., of Brantford, in which considerable local capital is interested, will seek incorporation and establish a factory in that city.

CEMENT IN BUILDINGS.

DEVELOPMENT and expansion in the cement industry during the last decade have been phenomenal. The reason is that the product is immeasurably cheaper than stone, brick, wood, etc., their equal for most purposes and superior for many. The uses to which it can advantageously be applied are almost beyond conception, so that its growth during the next decade will undoubtedly be more wonderful than that of the last. Within the last few years the process of manufacture has so much improved as to reduce the cost more than 100 per cent.

Portland cement is made from natural rock, known technically as Trenton limestone, and when produced in commercial form is a fine powder, possessing the quality, when moistened with water, of binding itself and substances with which it may be mixed into a homogeneous mass, settling with remarkable quickness and drawing to a hardness greater than that of granite. In this condition it neither contracts nor expands, is impervious to water and unaffected by the most intense heat or cold.

In its commercial form the cement can be molded into any required shape. It is used "neat" and in combination with either sand, gravel, crushed stone, cinders, clinkers or slag, dependent entirely upon the uses to which it is to be applied, strength of material required or appearance desired. Many block machines have been invented, and blocks of cement stone of any size, shape or ornamentation can be cheaply and quickly manufactured. These machines make a perfect imitation of stone in any desired color or form, and can be colored in imitation of brown stone, red stone or of a greenish or bluish tinge, making a building more ornamental than can be produced by any natural rock.

Portland cement with iron or steel is used with great economy in the construction of skyscraper buildings, and will doubtless be so used to the almost exclusion of stone and brick in the near future. Scarcely a modern building is now constructed or can be constructed without the use of cement. As was demonstrated in the great Baltimore fire, cement or steel and cement in combination, provide the only fireproof building material.

A New Method of Worm Wheel Cutting

By W. B. McLean, B.Sc.

WHILE worm gearing has been in use to some extent in the manufacture of machinery for a very long time, such rapid advances have been made in the methods of manufacturing it of late that it is practically a new business and the amount of worm

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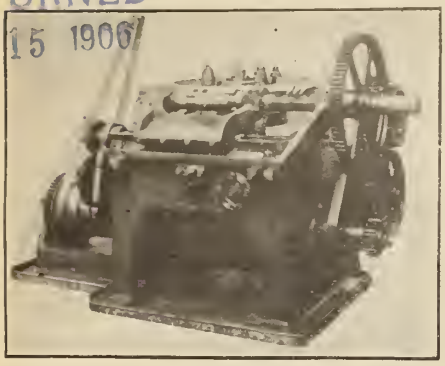

Fig. 1.

gearing which is in use has increased within the last eight or ten years by something like 300 to 400 per cent. and is still growing very rapidly.

The old fashion in making worm gearing was to cut the worm in a lathe and to cast the teeth in the worm wheel. Various methods, more or less intricate, are described in text books for designing the shape of the teeth, and no doubt if the best of them were worked out fully and carefully followed by the pattern maker and moulder we should get a tooth of approximately the correct shape and get a line contact right across the tooth for each thread of the worm in gear. These shapes are so difficult to draw, however, and so much more difficult to make when they are drawn, that in practice shapes of teeth in cast wheels are very far from correct and the thread of the worm only touches the tooth in one or two places.

Usually the thread of the worm will not go into the tooth space at all and then the tooth space has to be chipped with hammer and chisel to get a bit nearer and finally the worm is case hardened and left to grind the wheel down to the proper shape. It is no wonder in view of all these circumstances that there has been a very strong prejudice against the use of worm gearing and that it has been of very low efficiency.

As far back as 50 years ago Sir Joseph Whitworth devised a method of cutting worm wheels by means of either a single cutter or a hob. In his machine the wheel blank was revolved and the cutter or hob fed in directly towards the centre of the wheel. This, however, did not give a perfect form of tooth.

The modern method which has been in use for about ten years only is to set the axis of the hob or single cutter at the same distance from the centre of the wheel blank which the axis of the worm is to have in the finished wheel. The hob or cutter is fed from one side of the blank tangentially across it, emerging at the other side. The movement is equivalent to that of a worm driving a finished wheel and at the same time threading its way through it along its axis from one side of the wheel to the other. It will be seen that this method is bound to give a shape of tooth to fit the worm in every part, as, in fact, it is equivalent to the worm cutting its own wheel.

In the case of a machine of this description which has a constant feed by gearing or otherwise, that is to say, having the cutter moving tangentially through equal distances for each revolution of the worm wheel being cut, the revolutions of the cutter are in a compound ratio to the revolutions of the wheel being cut. This will be seen by considering two extreme cases: If the tangential feed were nil it will be seen that the case is exactly like that of a worm, of which the cutter is an equivalent, driving the wheel being cut, and the ratia of the revolutions would simply be that of the finished worm when

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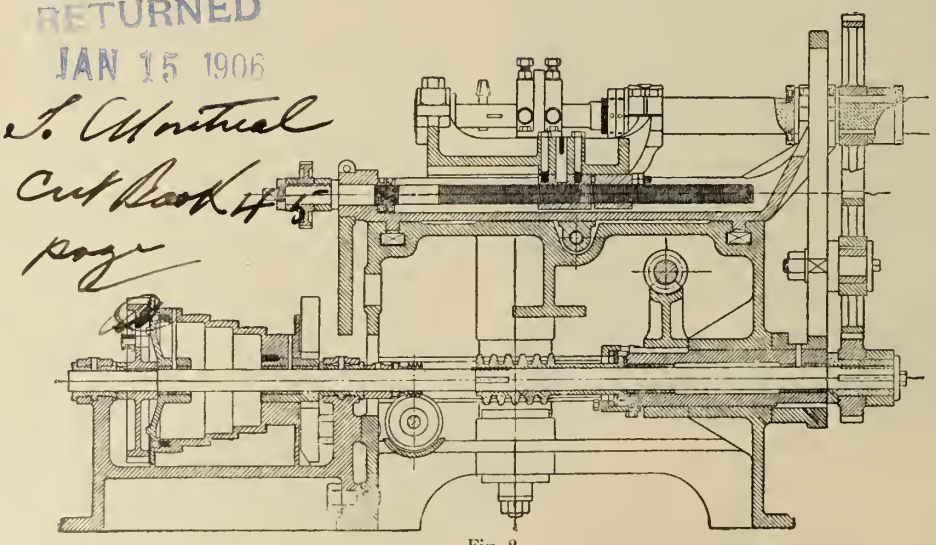

Fig. 2.

driving the finished wheel; if, on the other hand, the wheel being cut were not revolved at all but held steadily, and the cutter fed directly across it, then it would be like the finished worm threading its way through a fixed nut and the revolutions of the cutter would simply be the feed in inches per minute divided by the lead of the worm in inches..

We must here differentiate between lead and pitch. Worms are very often not single threaded like an ordinary screw, but double, treble and multiple threaded, as many as 11 or 12 thread worms are sometimes used. The term "pitch" is usually used to denote the distance between corresponding points of one thread and the next; the "lead" is the distance which a nut on the thread would move along the axis in one revolution.

In the case of actual worm gear cutting both of the above mentioned motions are going on at once and the resulting ratio which must be maintained between the cutter and the wheel being cut is compounded of both of them. To take a concrete case, suppose we are cutting a worm wheel of ratio 40 to 1 at 1-in. lead and the feed is 1-16-in. per revolution of the worm wheel, the ratio of the revolution of the cutter to that of the wheel being cut must then be $40 \pm \frac{1}{16}$. If the lead were 2″ the ratio would be $40 \pm \frac{1}{32}$, and so on.

In general, if the ratio of the worm of the finished wheel is called "r" and the feed in inches per revolution of the wheel be called "f" and the lead of the worm in inches be called "l," then the ratio of the cutter bar to the wheel must be

$$r \pm \frac{f}{l}$$

In all the earlier machines for cutting

worm wheels on this principle complicated arrangements involving the use of at least three trains of gearing were used for producing this ratio. The feed was produced simply enough by a set of change gears connecting with the wheel being cut and driving a lead screw which fed the cutter along its axis. The cutter bar was geared up by change wheels to the wheel being cut in the simple ratio of the worm of the finished wheel, then a complicated arrangement—usually a nest of bevels, or "jack in the box," as it is sometimes called—was resorted to for adding or subtracting from the revolutions of the cutter by an amount proportionate to the tangential feed of the cutter, that is to say, the two elements of the compound ratio were produced separately.

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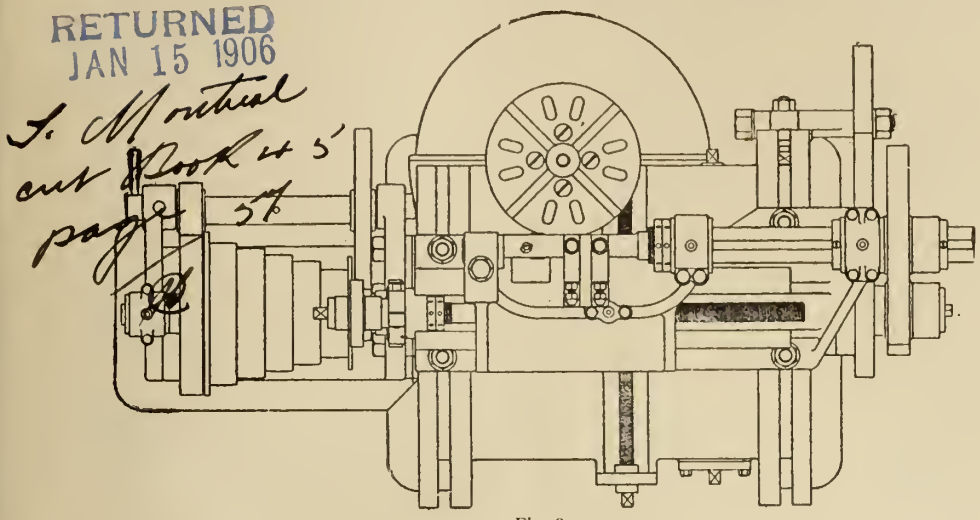

Fig. 3.

One advantage of this method over that which we are about to describe is that the feed may be varied across the face of the wheel, that is, it may be made faster as the cutter is just entering and leaving the wheel and slower at the centre. The great disadvantage is that it involves very complicated and expensive machinery.

In the machine designed by the writer only two trains of gearing are used; one is for feeding the cutter along its axis and may be seen on the left of Figure 1, the other is for connecting the wheel being cut to the cutter bar and may be seen on the right of Figure 1. This makes the simplest possible machine. It might be thought, however, that the compound ratio necessary for the gears driving the cutter bar would be so complicated that it could not be produced with any ordinary sort of gears. It will be seen, however, in the formula found above, viz., the ratio of gear required which we will call

$$g = r \pm \frac{t}{1}$$

that there are two quantities which may be varied, viz., that "g" is dependent on the feed "f" as well as on "r." It is not essential in practice that the feed "f" be exact; it may be varied slightly, say within 10 per cent. of the value which is required, that is to say, in a concrete case we want a feed of about 1-16; 1-15 or 1-17 would do as well. We can always find by a little calculation the value of the feed "f" which will give a ratio "g" which can be obtained with an ordinary assortment of change gears.

In proceeding to consider a concrete case of this we must observe the significance of the plus or minus sign in the formula. The cutter for several reasons must always cut on its down stroke, that is, so that it will not tend to lift the wheel off the face plate. In Figure 5 let the circle denote the worm wheel with the curved arrow showing the direction of rotation and the outside arrow the axis of the cutter or worm. It will be seen that the case shown is that of a right hand wheel. If the feed of the worm is in the direction shown by the outside arrow then the added motion due to the second element in the compound ratio is in a different direction to the motion due to the first element, that is to say, if the worm were going to thread its way through the wheel it would be moving in the opposite direction to that which it would be for driving the wheel as indicated, hence the minus sign must be used in the formula.

By similar reasoning it will be seen that the minus sign must also be used in the case shown in Figure 6, which is that of a left hand wheel, and in general the minus sign must be used when the direction of the feed is such as to follow the motion of the periphery of the wheel, and conversely the plus sign must be used when the direction of the feed is the opposite. It is found in actual cutting that it is best to feed with the periphery of the wheel and hence the minus sign is used in the formula.

As an example of the method of working out the gearing let us take the case of the 40 to 1 wheel with 1-in. lead of worm as mentioned above, the feed to be about

$\frac{1}{16}$. By the formula

$$G = 40 - \frac{1}{16} = \frac{639}{16} = \frac{9 \times 71}{16}$$

but 71 is an odd gear not likely to be

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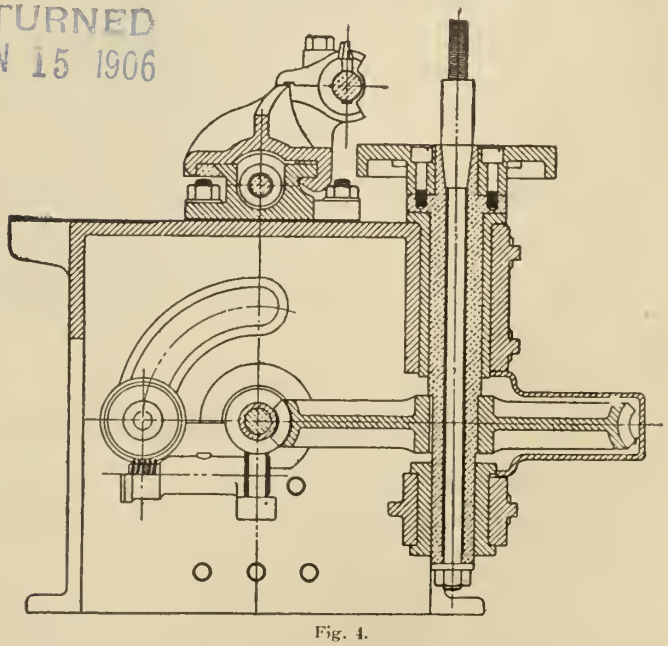


Fig. 4.

in stock. To get a better ratio proceed as follows:

$$40 - \frac{1}{16} = 40\left(1 - \frac{1}{640}\right) = 40 \times \frac{639}{640}$$

Refer to a table of prime factors of numbers which is used in these calculations and find two consecutive numbers

as near as possible to 640, both of whieh will factor out. Take say 637 and 638

$$40 \times \frac{637}{638} = \frac{20 \times 7 \times 7 \times 13}{11 \times 29}$$

Also working backward to the formula

$$40 \times \frac{637}{638} = 40\left(1 - \frac{1}{638}\right)$$

The feed ÷ lead is $\frac{40}{638}$.

The lead is 1-in. hence the feed to match the above gears is

$$\frac{40}{638} = \frac{20}{11 \times 19}$$

If the lead screw feeding the cutter has four threads to the inch the ratio of the feed gearing between the lead screw and the wheel being cut will be evidently

$$\frac{20}{11 \times 19 \times 4} = \frac{5}{11 \times 19}$$

In both the feed and cutter bar gearing the reduction is not all done by change gears. Part of it is done hy fixed gearing whieh is so arranged that an average case would require equal change gears.

A machine designed on these principles is manufactured by Messrs. H. Wallwork & Co., Limited, of Manchester, and has met with great success in England. Sectional drawings are shown in Figures 2 and 4, and a plan in Figure 3. The worm wheel to be cut is fastened on a horizontal faee plate as shown in plan towards the top of Figure 3 and in section at the upper right hand corner of Figure 4. This is driven by a vertical spindle shown in Figure 4, which has a worm gear attached to it. This worm gear is driven by a worm on a horizontal main driving shaft shown in the lower part of Figure 2. This driving shaft goes right through the machine and carries the driving eones and back gear as shown to the right of Figure 2 and 3, and at the other end carries the first of the change gears for driving the eutter bar as shown to the left of Figure 2. The cutter bar is earried on a carriage which slides in and out to adjust for different eentres and also trav-

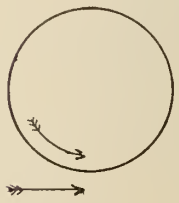


FIG 5

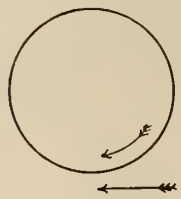


FIG 6

els across the wheel to give the tangential feed, being driven by a lead screw shown in the upper part of Figure 2 and in plan towards the centre of Figure 3. The feed gears are driven from the main driving shaft by a double worm and wheel arrangement shown towards the centre of Figure 4. The hox earrying this gear swivels on the main driving shaft and the outer spindle of it slides and may be clamped in any position in an arc shaped slot. The first of the ehange gears for driving the feed screw goes on this spindle and the movement in the slot faeilitates the gearing up. The swing frame for carrying the change gears for driving the cutter bar, which is of some weight when loaded up with the gears and would be awkward to manipulate by hand, has a special arrangement for moving it up and down shown in Figure 2. It is keyed to a sleeve which is free to move round in a hearing in the frame. The driving shaft runs through the centre of this sleeve in bearings and to the inner end of it inside the frame a worm wheel quadrant is attached and this is worked by a worm, which is supported in bearings in the frame. The ends of the spindle of this worm come out at both sides of the frame and are squared as may be seen in Figure 3. By working this spindle with a crank handle the swing frame may be moved up and down easily although heavily weighted, and may be nicely adjusted to bring the gears into proper mesh.

The machine may be used either with a single fly cutter or a hob. The fly cutter is shown in position in one of the arbors towards the top of Figure 2. These arbors, whieh fit into the end of the cutter bar hy morse taper and run in bearings, are of different sizes and may be easily removed and replaeed.

The whole machine is made very strong and with powerful drives with a view to using high speed steel cutters.

A PURPOSE.

Have a purpose in life, and having it, throw into your work such strength of mind and muscle as God has given you.

—Carlyle.

A Prayer.

The day returns and brings us the petty round of irritating concerns and duties.

Help us to play the man, help us to perform them with laughter and kind faces; let cheerfulness abound with industry.

Give us to go blithely on our business all this day, bring us to our resting beds weary and content and undishonored; and grant us in the end the gift of sleep.—Amen.

—Robert Louis Stevenson.

Power and Transmission

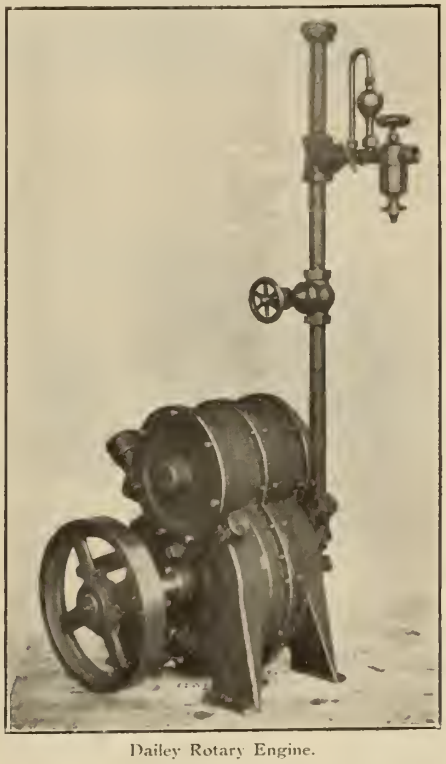
Steam Gas Electricity Compressed Air Water

OPPORTUNITY FOR GAS ENGINE BUILDERS.

PRODUCER gas at the present time is attracting considerable attention from power users. The attractive feature is the small coal consumption per horse-power that has been attained throughout England and Germany through the medium of this gas. In Canada and the United States this low coal consumption is now being demonstrated in not a few installations. England and Germany are the pioneer countries in the production of gas and gasoline engines, and there the design and mechanical construction of gas engines especially have reached a higher state of development than in any other country. Conditions peculiar to these countries is the reason for this. Naturally then, Canadian and American engineers have gone to these countries, particularly England, for data concerning gas and gasoline engines.

The most recent development along this line for comparatively small units has been the producer gas plant, consisting of the gas generator and engine especially designed for producer gas in a complete power plant. Of these producer plants the suction gas plant is receiving particular attention. Theoretically these producers are automatic in operation once the engine has been started, but the varying load on the engine in actual practice requires that even the best designed and constructed engine receive more or less regulation of air and steam supply. The efficient manner in which all otherwise waste heat units are utilized accounts for the economical generation and application of power by means of these power plants. In actual operation the gas is produced by the suction of the intake stroke of the engine drawing regulated supplies of steam and air up through a bed of incandescent coal. The steam is generated in a boiler surrounding the generator, and thus the heat units that would otherwise have been radiated are utilized and the heat units given off in the cooling of the gas to the correct temperature for use in the engine are also utilized in the heating of the water before it enters the boiler. The generation of the gas is started by means of a hand blower and after the engine has been started the operation of the plant is exceptionally simple if the load on the engine is constant. In the majority of cases, however, this is not so, and thus regulation of the air and steam supplies requires considerable attention in order that the quality of the gas may be kept as uniform as possible.

Considering the short time that the suction gas producer has been in use the economical results obtained are very creditable. Little unforeseen snags are often met with in the actual operation, and it may be some time before the producer has reached that stage of perfection that these little difficulties will no longer be met with. But this should in nowise discourage either the manufacturer or the user. It has taken many years to bring the steam plant up to its present degree of perfection. Considering the comparative efficiency of the suction gas plant with that of the steam plant as a basis for calculations, it is safe to predict a decidedly good future for the suction plant.



Dailey Rotary Engine.

At present producer gas generators for power purposes on the Canadian market are either English or American make, although several plants have been made in Canada for heating purposes. There are, however, several firms now experimenting along this line in Canada with a view to manufacturing. Some of these firms will probably make their own engines, while others will not, preferring to devote all their resources to the development of the producers. Since producer gas is so much less rich in heat units than ordinary coal gas or natural gas, that especially designed engines are necessary to get the most efficient results from producer gas, the chief feature of difference being the comparative smallness of the clearance chamber, which is to provide for the higher pressure necessary in the proper combustion of producer gas with the air.

In consequence there is a field for manufacturers of gas engines in the development, in conjunction with the firms manufacturing the producers, of a line of engines suitable for producer gas. Unless Canadian engine builders take advantage of this opportunity—which opportunity is great, viewing the producer gas plant in the light of its present achievements and future possibilities—it is probable that suitable engines will be imported from England to complete the producer gas plants made in Canada. The management of one firm, at least, has the importation of engines from England definitely in mind, unless some Canadian builder produces a reliable engine of the required type before their gas generators are ready to be placed on the market. Canadian manufacturers must take advantage of opportunities as they are presented, else manufacturers from other countries will step through the door standing open for them.

DAILEY ROTARY ENGINE.

IN the last issue an account of the remarkable engine invented by Mr. Chas. Hetherington, of Galt, was given. It was intended at the time to give an illustration of same, but the photograph arrived too late to have half-tone made. Herewith is presented a representation of same, so that readers may have as idea of the general features of the interesting little prime mover.

THE TURNER CARBURETTOR.

IN their endeavor to supply a simple and reliable carburetting device, the Turner Brass Works, Chicago, has designed two types, one for use with four-cycle automobile engines and one for two-cycle marine engines. The ae-

companying Figs. 1 and 2 show these two carburettors. They are made entirely of bronze, because iron has a tendency to corrode, interfering with the prompt action of the moving parts. The carburettor is of simple construction and is claimed to give a perfect mixture at all speeds and under all atmospheric conditions. It is described as a simple poppet valve carburettor and has as a distinguishing feature an individual constant vacuum system of control. The latter is said to overcome all such difficulties as irregularities of the mixtures at different speeds of the motor and imperfect vaporization of the fuel for starting in cold weather, and to dispense with the necessity of priming, heating or using high grade gasoline. In fact, the carburettor is not well adapted to gasoline of higher grade than 68 or 70 degrees. In cases of emergency wood alcohol may be used, and the motor will start with this fuel exactly the same as with gasoline.

Fig 3 shows two sectional views of the auto type carburettor which indicate the principle of its operation. The poppet valve E performs the function of the float as used in the regular feed type of carburettor for shutting off the flow of gasoline and takes the place of the throttle and auxiliary valves used in other carburettors. In other words, this one valve performs the functions of feeding, vaporizing and controlling the mixture and the quantity of it to be delivered to the motor. The valve also affords a cut off for the gasoline supply, which is not affected by vibration when in operation and is a positive and automatic cut off when the motor is stopped.

The poppet valve E is normally held to the seat S by the light coil spring G and auxiliary spring N, completely closing the air passage through the carburettor. It also seats on the end of the gasoline supply tube L-I, thereby preventing the flow of fuel except when drawn in by the suction of the motor. When it is desired to admit a full charge

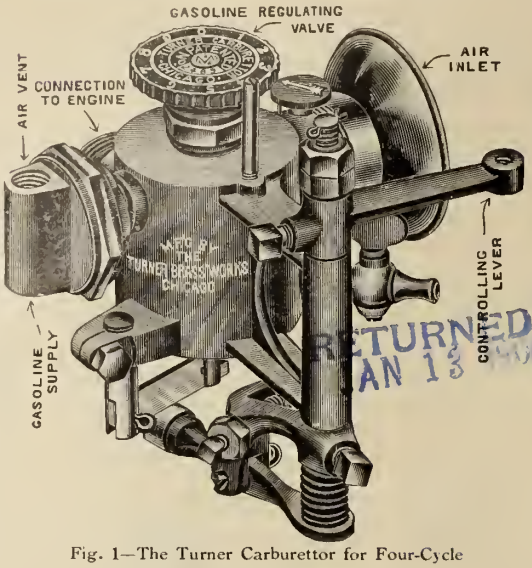


Fig. 1—The Turner Carburettor for Four-Cycle Auto Engines.

of air and gasoline, tension on the auxiliary spring N is removed, leaving only the tension on the light coil spring G

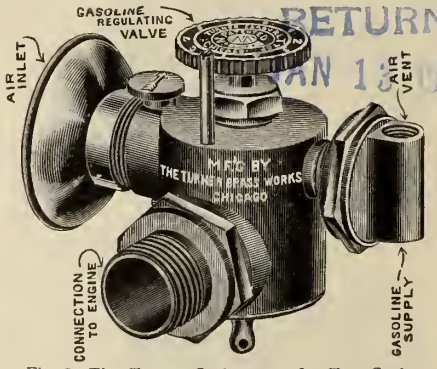


Fig. 2—The Turner Carburettor for Two-Cycle Marine Engines.

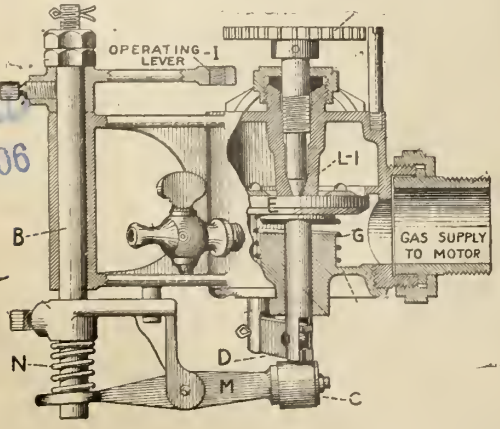
to be overbalanced by the engine suction. Under these conditions the valve will remain open during the full suction stroke of the piston. To decrease the charge admitted the tension of the auxiliary spring N is brought into action by turning the operating lever I; this acting through the rod B causes the lever M, through the roller C, to press with increased effect on the link D, which assists in holding the valve E closed. As a result a greater vacuum is formed before the valve opens to admit gas to the motor. In creating this vacuum a part of the stroke of the piston is spent, leaving only the remaining part to draw in the charge. The gasoline flow can be thus controlled in exact relation to the air supply and the vaporizing power increased as the size of the charge is reduced, making a positive feed of fuel certain regardless of the quantity.

One of the most valuable features of the Turner carburettor is that no change in the air or gasoline adjustments is necessary to maintain an absolutely even mixture between a full charge at any speed or the smallest charge that the motor will fire at the slowest speed. In starting the motor the poppet valve also affords a positive feed of exactly the right amount of fuel, and, due to the high vaporizing power, the motor will respond immediately to the first charge drawn through the carburettor.

B. C. MEN INVENT.

ACCORDING to a Vancouver paper two men of that city, a machinist and a locomotive engineer, have been granted a patent on an improved lock handle for stop-cocks.

This handle has been particularly designed for application to what is known as the angle cock, at each end of a vehicle, on the Westinghouse air brake train pipe, to prevent such stop-cocks being inadvertently closed. This unintentional closing of an angle cock, by cutting off the rear portion of a train from connection with the air brake



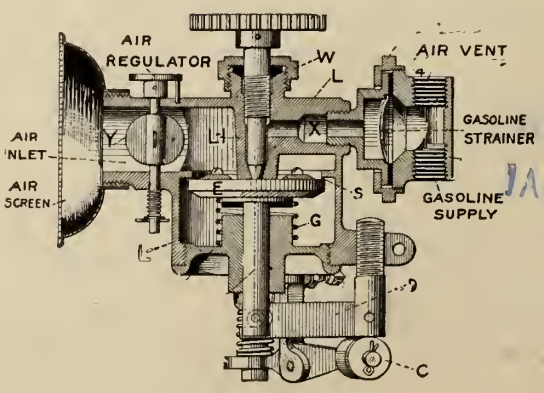


Fig. 3—Two Sectional Views of the Auto Type of Carburettor.

system, has been the frequent cause of railway accidents, which hitherto could hardly be considered as preventable. This handle, which is the subject of this patent, is provided with a detent which locks it in either the open or shut position as required, so that it cannot be accidentally moved.

The invention is a very ingenious and eminently practical one, and should be readily adopted by the various railway companies, as no modification of the body of the stop-cock is required, the old handle merely requiring to be removed and the new one substituted at a comparatively trifling expense, while it will save the recurrence of a class of accidents which are usually disastrous to rolling stock; and the cause of serious interruption of traffic.

The air brake companies will also be too willing to adopt an invention which will enhance the usefulness of their brake system.

A NOVEL WATER HOIST.

THE question of unwatering a mine always is a serious problem to the mine management, especially so when the water is highly impregnated with acids. When the amount becomes excessive the means to be employed for disposing of it taxes the ingenuity of all concerned to the uttermost.

In the anthracite regions there are mines in which for every ton of coal raised, as high as 14 tons of water must be pumped and the latter must be done at a minimum of expense. Nowhere, probably, have a greater variety of pumps and lifting devices been tried, and the most satisfactory type, up to date, for handling large quantities of water at comparatively low heads, have proved to be large boilers operated by steam engines. These, however, lack the mechanical regularity inherent in a pump, as they are necessarily operated by men, and it remained for the Delaware, Lackawanna & Western R. R. Co. and its electrical engineer, Mr. H. M. Warren, to finally develop a water-hoisting equipment which would preserve all the valuable points of the steam hoist and at the same time operate automatically. The carrying out of the mechanical details of the hoist and its automatic devices were confided to the Wellman-Seaver-Morgan Co., of Cleveland, Ohio, and the successful operation of the plant reflects great credit on the latter, as they guaranteed the machinery to accomplish the desired results. Most of the electrical controlling devices were furnished by the Electric Controller & Supply Co., of Cleveland, Ohio. In the original specifications the D. L. & W. R. R. Co., called for the hoist to be operated by an alternating current motor of 800 H. P. and the question of starting, stopping and reversing so large a motor had at the outset, to be met. The duty to be performed by the hoist called for the raising of 4,000 gallons of water per minute to a height of 550 feet.

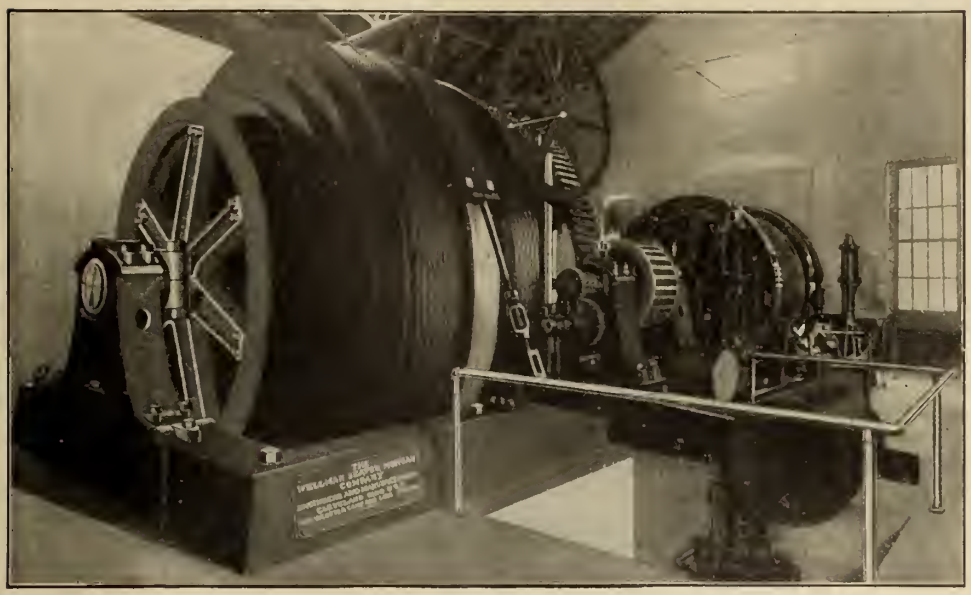


Fig. 1

4000 gals. × 8.27 = 33180 lbs.

550′ 2″ rope × 6.3 = 3465

36645 lbs. to be raised at 550′ per min.

$$\frac{36645 \times 550}{33000} = 610 \text{ net horse power.}$$

Weight of bucket = ½ weigh of water, so that weight on rope = 53,235 lbs. or nearly 27 tons, requiring 2″ steel rope.

It was decided in carrying out the design that it would be impracticable to design the hoist other than have a motor running continuously in one direction, as it is a well known fact that the amount of current required to accelerate a large motor of this type is enormous, and greatly interferes with the proper running of the power plant.

The D. L. & W. R. R. Co. desired to use an A. C. motor directly at the hoist, and as the motor was to run continuously in one direction, this necessitated the use of friction clutches for accelerating and reversing the load.

As the Wellman-Seaver-Morgan Co. had several smaller plants already in operation using A. C. motors on hoists which are operated similarly to the present hoist, and as they are running successfully, and the repairs and renewals for clutches had not exceeded that required for the other hoisting engines, it was decided to use this method.

Figs. 1 and 2 show a front and side view of the hoist. As will be noticed, the general arrangement consists of a motor driving a pair of bevel wheels through a single bevel pinion. The bevel wheels run loose on a shaft and are fitted with the well known Webster, Camp

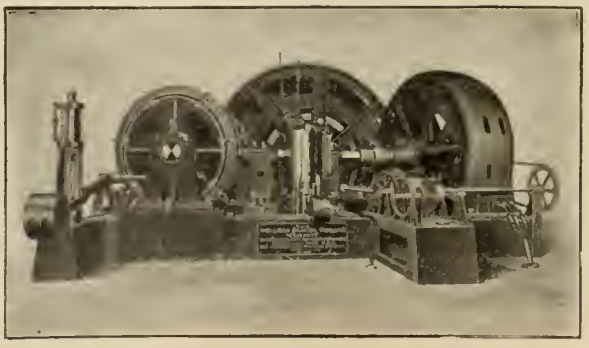


Fig. 2

& Lane friction clutches. The operating mechanism for the clutches are so designed that only one clutch can be thrown in at a time, but both clutches can be out at the same time. Throwing in one clutch runs the drum in one direction; throwing in the other clutch reverses the motion of the drum.

To the shaft on which the bevel wheels run there is keyed a pinion meshing with main gear on the drum shaft. The drums are of the cylindro-conical type 10 feet at the small diameter and 16 feet at the large diameter. At a hoisting speed of 550 feet per minute the drum makes about 15 R P.M. There is one main brake located between the drums. All of the clutches and brakes are operated by auxiliary air cylinders fitted with oil cushion cylinders, the compressed air being furnished by a motor driven air compressor and the necessary tanks located near to the hoist. The hoist is controlled by a mechanical device shown in Fig 2. This device consists mainly of a drum rotated by means of a friction drive from the motor through a sprocket chain. The drum shaft transmits its motion to a secondary shaft fitted with variable speed which in turn operates a secondary stop. The main hoisting drum shaft operates a traveling nut which is so located with respect to the controller drum that at either end of its travel it releases a stop and allows the controller drum to make a quarter turn; this movement, through suitable electrical connections, operates the solenoids on the clutch valve, releasing the clutch and the solenoid on the brake valve setting the brake, the further movement of the controlling drum being arrested by the secondary stop. This stop is released by the variable speed shaft and its connections, which has been given a predetermined time movement corresponding to the interval for emptying the bucket The further movement of the controlling drum releases the brake and throws in the reversing clutch, thus starting the hoist in the opposite direction, and also starting the traveling nut on the controlling mechanism in the opposite direction. At the end of the hoist the cycle of controlling movement is repeated and so on, making the hoisting operation continuous and automatic. Every attention has been given to the safe operation of the hoist. The main brake is of the gravity type and to be released the current must be on the solenoid operating the valve so that air can be admitted to the underside of the brake piston. If for any reason, either the supply of current or of air pressure is interrupted, the valve drops, and the weights on brake lever set the brake. The clutches are designed so that they are thrown out by weights. As is the case with the brake, either clutch can only be thrown in when the current is on the solenoid, and the air pressure admitted under the piston, and if either current or pressure fail, the clutch is off. The motor shaft is fitted with an emergency brake operated by a weight controlled by a solenoid—any interruption in the flow of current to the motor sets the brake and stops the motor. Any interruption of the flow of the current stops the machine, throws out the clutches and puts on the brake. A safety cut-out is provided for in the head frame so that in case a bucket is carried beyond the proper height, the current is cut off. Fig. 3 shows the head frame. The head frame is 93 feet from the base to the centre of the sheave at the top. It is built of structural steel, roughly in the shape of an "A." From the head frame are suspended two buckets 6 feet in diameter and 19 feet 6 inches deep. The capacity of each bucket is 17 tons of water. In the bottom of the bucket are located two lift gates with an area practically equal to the cross section of the bucket.

These gates are lifted automatically when the bucket reaches the top, and the water is discharged through the bottom into a spout fitted below the bucket, and which deflects it to either side of the shaft. Each bucket makes a complete round-trip in one minute and fifty seconds, the total lift being 555 feet.

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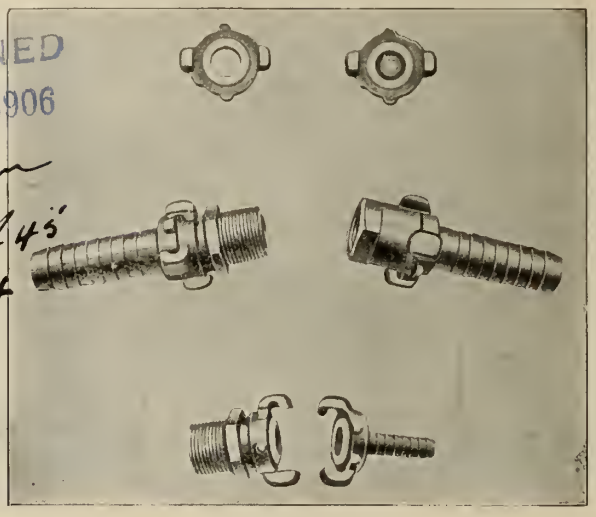


Chicago Hose Coupler.

Fig. 3

THE CHICAGO HOSE COUPLER.

THE Chicago hose coupler was designed to meet the demand for a universal coupler whereby a plant once standardized could economically thereafter be maintained standard without extra expense for specially con-

structed couplers to suit various sizes of hose used with pneumatic tools.

As to how perfectly the manufacturers have succeeded, we will leave the subject to the opinion of those requiring such equipment, after a test of the device in question.

By reference to the illustration it will be observed the Chicago coupler has no male or female part at coupling end proper, but instead, each half has embodied therein both male and female features, whereby each and every half is exactly the same and will couple regardless of the size and style of the shank, rendering the same an universal coupler in every sense of the word. It will readily be seen that quarter inch hose may be coupled with three-quarter inch hose, one inch pipe, or to anything having one of the Chicago couplers attached to it.

The shanks are manufactured for pipe male thread, pipe female thread, and hose in standard commercial sizes one-quarter inch up to one inch, which enables all couplings to be made without resorting to reducers or special shanks to meet the conditions presenting themselves where pneumatic tools are in use.

These couplers are manufactured by the Chicago Pneumatic Tool Co., who have arranged to carry a large stock constantly on hand which they are enabled to do from the fact that their manufacturing facilities are equal to 500 sets per day.

RETURNED
JAN 13 1906
T. Owen
Cut Book 45
page 45

Improved Ventilator Fan.

BLAST FURNACE GAS.

PROPER precautions regarding blast furnace gas and its possible effect on the workmen engaged in the blast furnace is often not considered, or, if considered, not acted upon as the occasion demands. Safety to workmen and protection of human life should be the foremost consideration in every industry and yet too often accidents occur that with slight attention and proper foresight could well have been avoided. In a paper read before the Iron and Steel Institute some good suggestions regarding avoiding accidents due to blast furnace gas were brought out. It was intimated that where practicable all gas flues and gas pipes should be placed above the ground and if possible above the breathing level, and that when the gas flues are under ground they should be built of blue bricks set in cement, while the man-holes leading to these should be equipped with lids ensuring the maintainence of perfect gas tightness. All habitable buildings should be thoroughly well ventilated. The ground surface below the building should be covered with a layer of cement concrete, and an open air space should be formed between the cement surface and the flooring boards of the building. Forced ventilation should be the principle adopted for all occupied buildings in iron and steel works. An air-supply tapped from the cold blast main may be found useful in this connection. The gas engine exhaust pipes should terminate at a considerable altitude above the works air tube of the blowing engine should be supplied from the engine house. Especial precautions should be taken during flue and stove cleaning periods, and in blowing in furnaces. Enamel lettered warning notices should be prominently posted throughout the works. Fines should be imposed on workmen for gas risks carelessly undertaken. A paid ambulance corps should be established. During the blowout period of the slag tapping operations the men should be withdrawn from the zone of gas escape. The time allowed to be occupied in gas producer poking operations for individual men should be limited to three minutes. The reversing valve pits of gas-fired furnaces should be well ventilated. Roll call checks of labor employed in gas flue and stove cleaning operations should be established. If power gas pipes have to be placed underground, they should be placed in grate covered open trenches, and the pipe flanges should be planed.

Following out all the suggestions mentioned would mean some added expense and, for a time at least, considerable attention, but the matter is worth thoughtful consideration by all interested.

IMPROVED PROPELLER FAN.

IN the illustration shown in this page an idea of the improved propeller fan recently placed on the market by the McEachren Heating & Ventilating Co., of Galt, is given. This fan is of new and improved design. It is not at all like the ordinary disc fan, nor like former patent disc fans. As will be seen by the illustration, the wheel has no band around it. The whole wheel stands out in the space from which the air, steam, gas, etc., is to be taken.

What is peculiar about this fan is that it takes in air all over the face of the wheel and all around the periphery, and discharges it nearly all over the surface of the opposite side of the wheel but mostly at the centre.

If this fan has to be inserted, or partly inserted, into a wall or tube, it is necessary to have the space around the periphery of the wheel not less than from 12 in. to 24 in. larger in diameter than the diameter of the wheel.

These fans are light; they are adapted for placing in windows or hanging to ceilings. Although of light weight, they are strong, the castings being all angles and tees, which is the strongest form in which a given weight of metal can be employed.

The fan illustrated is adapted for fastening to a wall or partition, but fans are supplied with feet to stand on a floor or platform, or to run on a vertical shaft in steel step if required, and with but small extra charge.

The Dominion Iron & Steel Company will add two Bessemer converters to their plant so as to increase their steel output sufficiently to meet demand for rails. This means an increase of 35 to 50 per cent. in the company's present output of steel, and it is expected the monthly output will be 20,000 tons next year.

ABOUT CATALOGUES

By mentioning Canadian Machinery, to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

Sturtevant Enginnering Series. The B. F. Sturtevant Co., Boston, Mass., will hereafter issue most of its publications periodically under the title, Sturtevant Engineering Series. Tach individual bulletin will treat of some particular product or its application. The series will also include reprints of pertinent articles or technical papers. All publications will be issued in uniform style and size suitable for binding consecutively or in allied groups. Bulletin No. 125, the first of this series, has just been published. It describes in detail the line of automatic vertical engines manufactured by the B. F. Sturtevant Co. These range from 5 x 5 inches to 12 x 10 inches, are entirely enclosed and all bearings are provided with positive forced lubrication under 15 pounds pressure. hese engines primarily designed to meet the exacting requirements of dynamo driving, are capable of continuous operation without skilled attention and represent the highest standard of material, workmanship and efficiency.

Pneumatic Appliances for foundry and concrete block work. Special Circular No. 55, issued by Chicago Pneumatic Tool Co., Fisher Building, Chicago. Besides describing pneumatic appliances, this booklet gives some good information on coloring concrete and its preparation. Twenty-four pages, 6x6 inches.

Slab Milling Machines. The Newton Machine Tool Works, Philadelphia. are sending out their Catalogue No. 42, devoted chiefly to a description of their horizontal slab milling machines. Other lines manufactured by this firm are also described and illustrated. 24 pages, 6 x 6 inches.

Lubricating Graphite. The United States Graphite Co., Saginaw, Mich., are sending out to engineers and others particularly interested in lubrication, a sample of their graphite accompanied by an interesting pamphlet on the subject. Anyone interested will receive a sample from the above firm on application.

Monthly Stock List. The December list of new and second hand engines, boilers, steam appliances and other power equipment, iron and woodworking machinery, has been issued by H. W. Petrie, Toronto. This list covers a wide range and is very complete. It may be had for the asking.

Cooley Engines. A pamphlet given to a type of rotary steam engine being placed on the market by the Cooley General Development Selling Co., Boston, Mass. These run from 1 1-2 horse power, with a weight of four pounds to twenty-nine horse power, weighing 835 pounds; the price ranging from $25 to $250. This is something very much out of the ordinary in the way of a steam engine. 15 pages, 3 1-2 x 6 inches.

Punching Machines. Literature including circulars and pamphlets is being sent out by Edwin B. Stimson & Son, New York, showing the different styles of punches made by them.

Portable Tools. H. B. Underwood & Co., Philadelphia, manufacturers of portable tools for railway repair shops, have issued a well illustrated catalogue dealing with the special tools manufactured by them. These cover a very wide range and are applicable not only to railway repair shops, but other shops as well. They include some very special apparatus of their own design and make, so that anyone having occasion to use tools for repair should send for a copy of this catalogue. 36 pages, 6 x 9 inches.

Gisholt Tools. Two bulletin circulars have been received from the Gisholt Machine Co., Madison, Wis. One of these describes the Gisholt motor driven boring mill of new design. The other takes up their motor-driven lathes, showing how they may be motor equipped. A commendable feature of these bulletins is that they are sent out in the form suitable for binding and thus more easily kept. Size, 8 x 10 inches.

Bulletin of the Imperial Institute. No. 2 of Vol. 3 of the Bulletin of the Imperial Institute, South Kensington, has been received. Besides the Indian and colonial collections, this is devoted to scientific and technical investigations, general notices respecting economic products and their development, notes on recent literature and library, containing in all a large amount of useful information.

Woodworking Machinery. The large catalogue of Jackson, Cochrane & Co., Berlin, Ont., contains complete information regarding their improved and patented woodworking machinery. It covers the entire range of the woodworking field, the illustrations being large, and therefore the details are brought out in a very satisfactory manner. It contains over 100 pages and is printed on heavy coated paper. Size, 9 1-2 x 12 inches.

Economy. An article published by the Murphy Iron Works, Board of Trade building, Toronto, on the economy of cost for power and smoke prevention, giving a great deal of information regarding the conditions in connection with using boilers, and also pointing out how coal may be saved in using the Murphy boiler. Size 6 by 9.

Westinghouse Standard Engine. An art catalogue of 35 pages, describing the standard steam engine built by the Westinghouse Machine Co., East Pittsburg, Pa. The illustrations contained are of a high order, in keeping with the literature usually issued by this company. Illustrations are given of different parts as well as sectional views of the vital features of the engine. Everyone interested in engines should have a copy of this. Size, 6 inches by 9 inches.

Water Lifted by Compressed Air. This catalogue has been received from the Ingersoll Sergeant Drill Co., and besides describing with full complement of illustrations the subject mentioned, it gives a large amount of valuable information regarding the arrangement of wells and piping and the different applications of air compressors. 95 pages, 5 by 9 inches.

Water Softener Plants. A technical and well illustrated description of the water softening and sterilizing apparatus manufactured by the St. Lawrence Water Softener & Sterilizer Co., Limited, London, Eng. Its application to use for town supply and for public and private use is also dealt with. 38 pages, 6 by 9 1-2 inches.

The Smart-Turner Machine Co., of Hamilton, have recently supplied automatic feed pumps and receivers to the Beek Mfg. Co., Penetanguishene; the London Machine Tool Co., London; Wilson Scale Works, Toronto; John Bertram & Sons, Dundas; the Iron Mask Mine, British Columbia; H. K. Wampole Co., Perth.

Practical Questions and Answers

Kinetic Energy.

Ques.—What is the kinetic energy for a rotating body, and how is it computed?

Ans.—The kinetic energy for a body with a motion of translation was discussed in a recent issue of Canadian Machinery, and it was found that choosing suitable units :

$$K.E. = \frac{m\,v^2}{2}, \text{ where}$$

m = mass of the body,

v = velocity.

In a rotating body we have to deal with angular velocity instead of velocity in a straight line, and with the "moment of inertia" instead of with the mass. The formula for the kinetic energy of a rotating body is :

$$K.E. = \frac{I\,\omega^2}{2}$$

where I = moment of inertia of the body,

and ω = angular velocity in radians per sec.

Both of these terms will need some explanation.

First, consider angular velocity. Angular velocity may be measured, and generally is measured, in revolutions per minute, or it may be measured in radians per sec. In one revolution there are 2π radians; that is 360 degrees, a complete rev., is divided into 2π parts, each part being called a radian. Thus, to change a number of revolutions per minute into radians per sec., the number should be multiplied by $\frac{2\pi}{60}$.

To understand the term "moment of inertia," consider a small mass at the end of a string rotating about a centre. The moment of inertia of this body will be its mass multiplied by the square of its distance from the centre of rotation.

Thus the kinetic energy of a small lead ball weighing 0.25 pounds rotating about a centre 2 feet distant at 50 rev. per minute would be :

$$K.E. = \frac{I\,\omega^2}{2} = \frac{0.25 \times 4}{2} \times \left(\frac{50 \times 2\pi}{60}\right)^2$$

foot pounds, = 13.52 foot pounds.

In this example it is simple to find the moment of inertia, but where the mass is in the form of a disk, the centre of the disk being the centre of rotation, or of some modification such as a flywheel, it is more difficult. However formulas have been deduced for the finding of the moment of inertia of different shaped bodies, and these formulas are contained in most mechanical pocket books. For instance, the moment of inertia for a circular disk rotating about its centre is given by the formula :

$$I = \frac{m\,a^2}{2},$$

where m = mass of disk,

and a = radius.

* * *

Boiler Heating Surface.

Ques.—In steam boiler making what is considered as heating surface?

Ans.—The general conception of heating surface among boilermakers at the present time is any surface which is exposed to water on one side, and fire or hot gases on the other side. No discrimination is made between heating surfaces because of the greater effectiveness of one over another, except that in the design of a boiler the tube surface is made not less than a certain percent of the total heating surface, depending upon the style of boiler.

There is considerable difference of opinion as to whether the tubular surface should be reckoned from the inside or outside diameter. Because the outside diameter of tubes are standard it is more or less general practice to reckon the heating surface from the outside diameter because of the greater ease of computation, but since the resistance to the passage of heat from the hot gases to the water is practically all due to the resistance of the metal, it would seem to be more correct to reckon as the heating surface that next the hot gases, i.e., from the inside diameter in fire tube boiler and from outside diameter in water tube boiler.

* * *

Horse-Power for Lathes.

Ques.—Are there any formulas in existence from which the power required to run lathes can be found?

Ans.—There are such formulas made up from tests conducted by different men. However, because of the extreme variance in the make of large lathes, it has been found impossible to deduce a formula which will give at all approximate results for the horse-power. But for the smaller lathes, say under 20-inch swing, there are formulas giving approximate results.

The power required to drive a working lathe depends upon the power required to drive the lathe empty, upon the nature of the material being machined, upon the amount of metal removed in a given time, and upon the shape of the cutting tool.

The following formulas are given by Kent, in his hand-book for finding the horse-power required to drive lathes under 20 inch swing running empty :

(1) Back gears out :

H.P. = 0.095 + 0.0012 N

(2) Back gears in :

H.P. = 0.10 + 0.006 N,

where H.P. = horse power,

and N = revolutions of spindle per minute.

The power required to remove metal can be determined more accurately and without regard to size of lathe. The following formula is given by Dr. Hartig for this :

H.P. = C.W, where

C = constant for different material,

and W = weight in pounds of the chips removed per hour.

In obtaining the constant "C" for the different materials an average value was taken of experiments with various shaped tools. Values of "C" are :

Cast iron — C = 0.030

Wrought iron — C = 0.032

Steel — C = 0.047

The total horse-power required would be the sum of the two.

* * *

Proportions of Keys.

Ques.—Can you supply me with formulas for the dimensions of the different kinds of keys in terms of the diameter of the shaft?

Ans.—The following emperical formulas correspond to general practice :

d = diam. of shaft.

b = breadth of key,

and t = mean thickness.

Sunk keys :

b = 0.21 d + 0.04,

t = 0.12 d + 0.04.

Feather keys :

b = 0.12 d + 0.125,

t = 0.15 d + 0.06.

Keys on flats :

b = 0.25 d,

t = 0.08 d.

The taper of keys varies from 1 in 64 to 1 in 100.

These emperical formulas assume that the total amount of power carried by the shaft is transmitted through the one key; and thus, if power is taken off at various points along the shaft, the dimensions for the keys for the pulleys taking off this power at the several points would be unnecessarily large. The exact dimensions necessary for the keys in the different cases can only be determined by computation from the horse-power taken off at the various points.

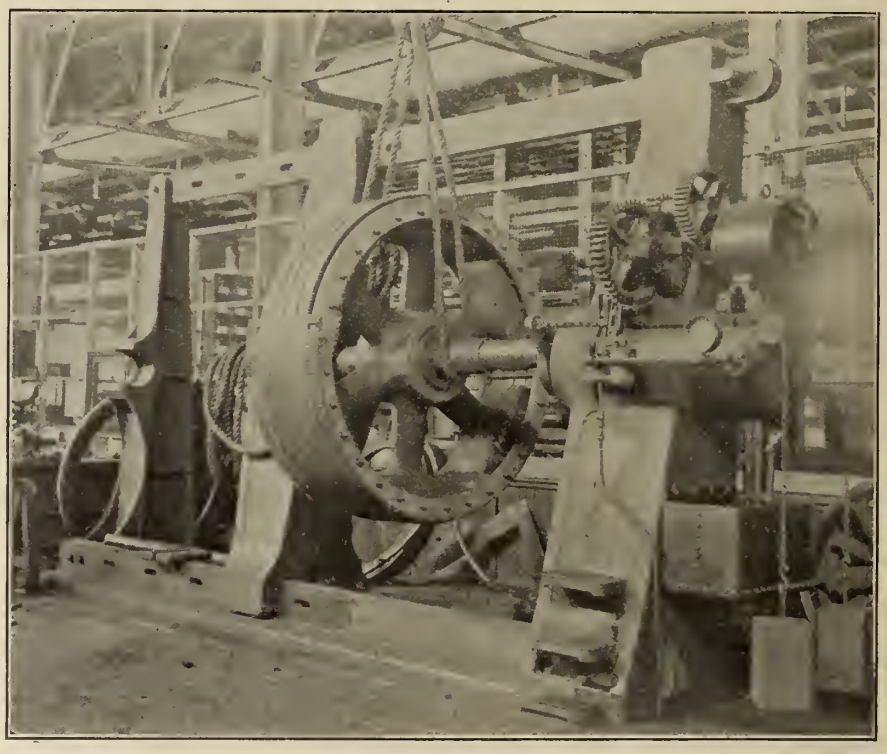
Machinery Development

Metal Working **Special Apparatus** **Wood Working**

200 TON HYDRAULIC PRESS

THE machine here described and illustrated, has been recently installed at the works of the Allis-Chalmers-Bullock, Limited, Rockfield, Que., by the John McDougall Caledonian Iron Works, Montreal.

Prominent in the design is the space of the longitudinal tension bars, the inclination, 30 degrees, of the whole upper structure, the massive proportions of the strain bearing units, the compactness of management and the ease of manipulation. The outfit is primarily intended for pressing rotor and armature spiders on to the shafts of the larger electrical machinery and the determination of the space, 10 feet, between tension bars, was arrived at by providing for the handling of a revolving element belonging to the largest machine that the present equipment of the Rockfield works can otherwise just at present undertake. Since the installation of the press, its full capacity between the tension bars has been taxed and the highest satisfaction is being had under all conditions of operation and varieties of work. The idea of inclining the upper structure is to permit of the crane hook and sling passing clear of the upper tension bar, thereby enabling the pieces for pressing to be lowered perpendicularly into place without recourse to side or cross pulling and its atendant disadvantages and risks. The machine is entirely self-contained, being mounted on a substantial cast iron base, with provision for permanent molting to a concrete foundation if so desired. The maximum space between ram and resistance head is 20 feet, the overall length, 23 feet 3 inches, the extreme width, 5 feet 6 inches, and the extreme height 13 feet 3 inches. The tension bars are of cast steel, the ram, ram head, resistance and carrier heads being of high tensile strength, cast iron. The ram is 14 inches diameter by 36 inch stroke, operated by a motor driven duplex pump, with all-brass case and plungers, brass valves on steel seats, designed for a working pressure of 2,600 lbs. per square inch. The city water main connects direct to the pump suction, thereby allowing the ram to be run up to its work while the pump and motor are being started. The motor, an A-C-B, 5 H.P., 240 volts, 1,050 1.p.m. transmits its power to the pump driving shaft by double reduction machine cut gears, reducing the speed at the pump to about 100 strokes per minute. The ram is fitted with one ordinary cup leather ring and is arranged to return automatically by means of counter balance weights when the release valve is opened. A pin safety valve with lever and weight, a pressure gauge registering tons load and pounds per square inch on sectional area of ram, give a necessary finish to the hydraulic equipment. The resistance head has a carriage attachment at its lower end, having wheel rollers with large bearing surfaces, which together with the rollers on the upper tension bar, make this unit easy of movement in either direction by hand power alone. The complete machine weighs 52,000 lbs. and although of extreme dimensions, is arranged for easy access to and manipulation of all parts with a minimum of labor. It is therefore suitable for work of a varied nature and is a valuable addition to the plant of any up-to-date engineering or electrical establishment. It occupies a small floor space and being self-contained can be set in a corner. The material is all special of its kind, tested for strength, and the workmanship such as to reflect the greatest credit on the builders. The successful issue of the work, which marks a new departure for the John McDougall Co., is but one more instance of the hidden resources of the engineering profession in this Dominion and of the growing desire to unearth these resources, so as to be able to take up competition with the older established concerns, of other countries, and why not?



200-Ton Hydraulic Press.

TAYLOR-McKENZIE PUNCH.

In a reference to this punch in last issue the paragraph referring to the capacity of the machine read "capable of taking bent iron" instead of "capable of taking hand iron." This firm make wood lathes amongst other wood-working machinery instead of wide lathes as printed before.

AN INTERESTING STORY.

IN connection with the machine illustrated herewith, there is an interesting story attached. The device shown is an installation in the work of the Niles Tool Co., of Hamilton, Ohio, made by the Pilling Air Engine Co., Detroit, Mich., and is told in the words of Mr. J. L. Pilling, as follows:

"You know the Niles Tool Co. build some very large planers and lathes, and the 'V'-shaped groove upon which the planer and the head of the lathe travel have to be emeried down, for which purpose they have a saddle which weighs according to the size of the lathe. But one time while I was in Hamilton, they had a two-ton saddle and four men at each side, pulling back and forth the saddle to smooth down the groove of the planer. I went home, designed the machine of which you have a half-tone, and sent it down to them, not saying a word. In about two months I went down there and told them that a clerk had shipped a machine by mistake and that I had come after it. They asked me to describe it. I told them what it was, and they said if I undertook to take that machine out of there I would get shot. That braced me up in such a manner that I asked and received a third more for the machine than I intended to charge upon my entrance into their shop. They use that device for various purposes. They haul it around the shop and use it for hoisting, and moving cars (which run right through the shop), and it has proved to be a valuable investment to them."

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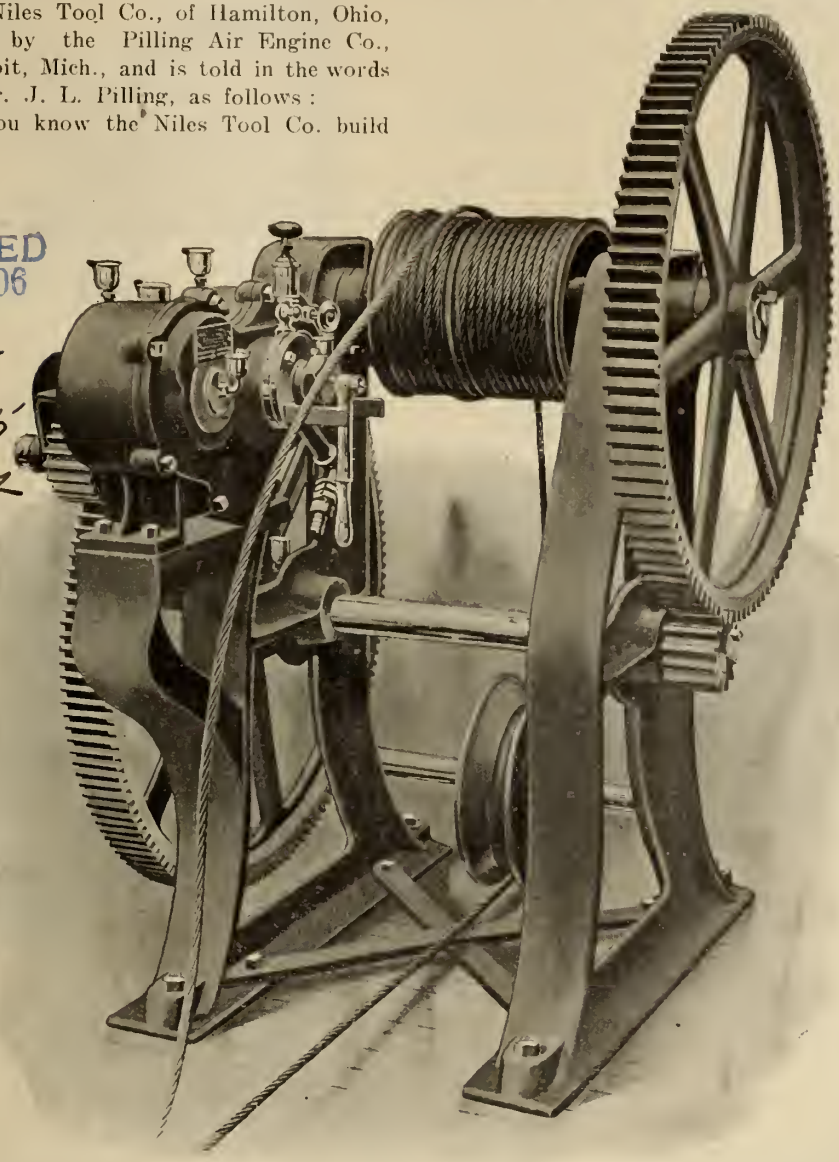

Fig. 3.—An Equipment for Traversing Heavy Parts of Machine Tools.

CINCINNATI SHAPER PARTS.

RECENTLY the Cincinnati Shaper Co., of Cincinnati, became established in their new shop, situated on a 3½ acre tract of ground in the heart of the machine tool industry, giving them better facilities than ever for turning out a high-grade product. They have devoted particular attention to the manufacture of shapers of the pillar or column and traverse head types, their attachments, etc., and to a new line of traverse grinders, in connection with which they have gone liberally into jigs and special appliances to secure a high standard of accuracy.

RETURNED JAN 15 1906

Fig. 1.

Some of the parts as illustrated herewith will give readers a better idea of the details and extra attachments provided for these shapers. In Fig. 1 is illustrated the variable automatic power down feed, which is furnished with the traverse shaper, being adjustable for position of slope and being independent of spring is positive in action. A blank boss is left on the rams of all pillar shapers, so that this attachment may be supplied subsequently. Fig. 2 shows the concave attachment which can be operated in any position of the ram, namely, close to or away from the column. It is positive in its action, and by varying the position of the down slide will work concave surfaces of different radii. The revolving table is shown in Fig. 3, which is particularly useful in die work of a complicated nature. It permits, with a swivel base, vise holding a piece of work at any compound angle. It is revolved on a trunnion by means of a pinion and gear, and has a motion of

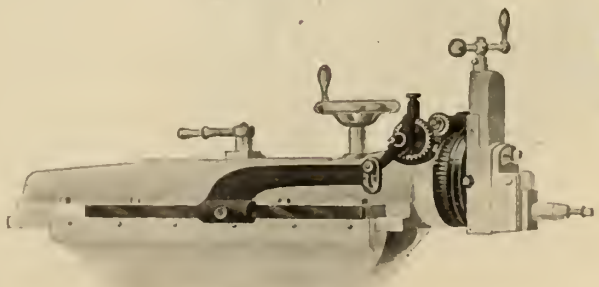

Fig. 2

90 degrees in either direction. In Fig. 4 the tilting table is shown. It is firmly hinged at the top of the apron and is held in an angular position by means of links, shown, and compression screws

Fig. 3.

through the table from impinging against the apron. In Fig. 5 the tilting top for tables is shown hinged to

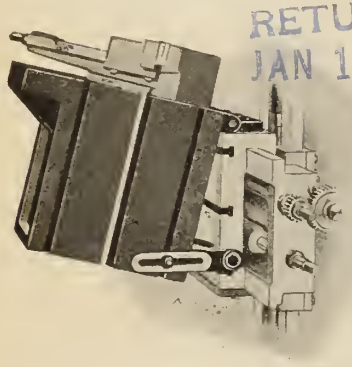

Fig. 4.

the apron. It may be angled and firmly bolted as shown in the illustration. It has independent sides to allow for operating the vise stud nut beneath when in a horizontal position. This attachment is readily removable for restoring the machine to the original form of table. The 10-inch swing cone arbor for attaching to the table, designed for either hand or power feed, is shown with power feed, and in Fig. 7 the 16-inch swing cone arbor for attaching to the apron is illustrated. It is likewise made for hand and power feed and, like the other, is shown with power feed. In Fig. 8 may be seen the full swing cone arbor for attaching to the apron, and which affords unusual range for work of large diameter. For heavy work the arbor may be supported at the outer end. When made for hand power only the power feed parts are omitted and the shaft is turned by means of a crank.

LATEST RADIAL DRILL.

IN this machine is represented the latest product of the Bickford Drill & Tool Co., of Cincinnati, Ohio. Its capacity for drilling from the solid is rated at 2 inches for steel and 2½ inches for cast iron. Of new design throughout, the tool contains many improvements over its predecessors, but its chief characteristic lies in the speed box which, without the back gears or a clutch of any kind, gives instantly, with a single lever, six changes of speed.

Referring to the diagram, it will be seen that the speeds are obtained by means of a primary shaft (c) which turns fixed gear (d) and sliding gear (b), a tumbler plate (a) which fulcrums on shaft (c) and carries an intermediate gear (e) for transmitting power to any one of the fixed gears (g), (h), (i), (j), or (k), an intermediate gear (f) for transmitting continuous motion from fixed gear (d) to loose gear (l), which carries a pawl and runs on the hub of a ratchet keyed to secondary shaft (m), and a device for automatically engag-

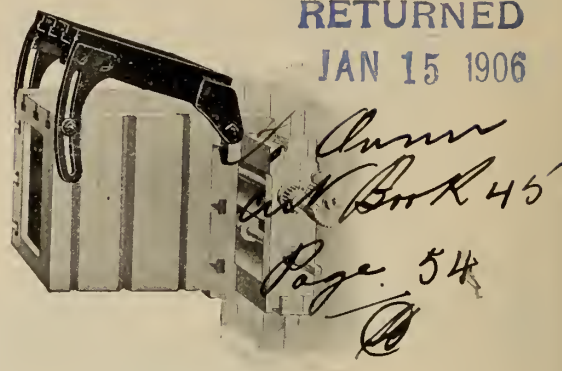

Fig. 5.

ing the pawl or keeping it away from the ratchet.

The slowest speed is obtained by sliding the tumbler plate (a) to the last notch on the right, when the intermedi-

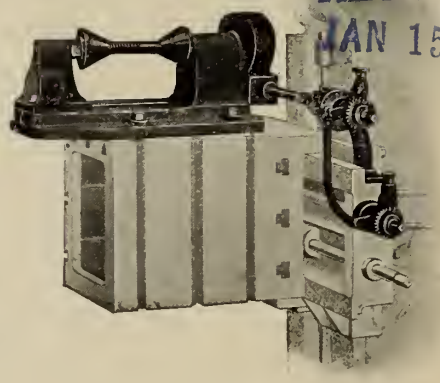

Fig. 6.

ate gear (e) occupies the space between gears (k) and (l), and the power is transmitted to shaft (m) through gears (b) and (l). Moving the tumbler plate to the next notch brings intermediate

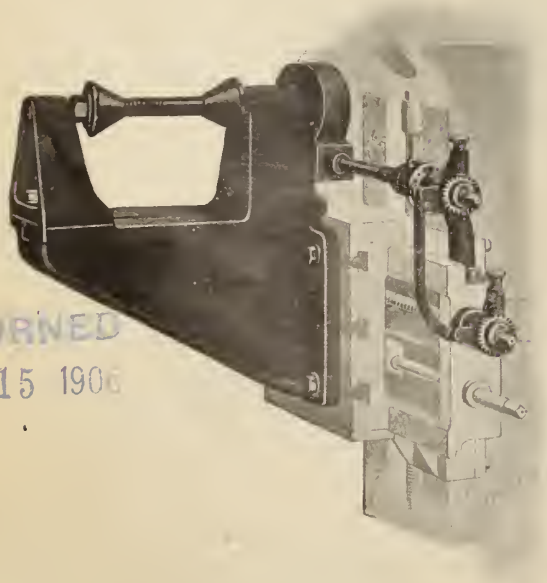

Fig. 7.

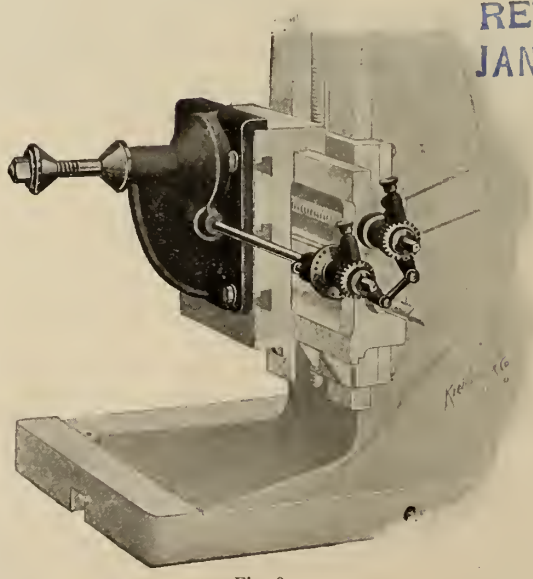

Fig. 8.

gear (e) into engagement with gear (k), which makes gear (b) the driver and causes the ratchet on shaft (m) to run away from the pawl in gear (l). Shaft (m) is, therefore, always running, for the moment its speed drops below that of gear (l), the pawl in gear (l) acts automatically and keeps it turning at its minimum speed until gear (b) is again made the driver.

As the minimum periphery speed of the smallest driven gear (g) is but 182 feet less than the periphery speed of driving gear (b), the shock which usually accompanies engaging gears broadside is reduced to a minimum, such shock as there is being absorbed by the belt. Another good feature of this drive is the high belt speed attainable at low gear speeds. Shaft (e) runs at 350 revs. per min., while the perpiphery speed of no gear in the box exceeds 301 feet per min.

This speed-box, augmented by the back gears on the head, gives the machine twelve changes of speed, the range and gradations of which are shown in the following table :

No. of revs. per min. made by spindle.	Diam. of drills for which speed is suitable.	No. of feet per min. at which drilling is done.	No. of feet per min. at which drilling should be done.
265.09	$\frac{1}{2}$	34.60	35.0
209.86	$\frac{5}{8}$	34.34	34.3
173.68	$\frac{3}{4}$	34.10	33.6
143.91	$\frac{7}{8}$	33.07	32.9
122.84	1	32.16	32.2
104.29	$1\frac{1}{8}$	30.72	31.5
95.41	$1\frac{1}{4}$	31.22	30.8
75.53	$1\frac{1}{2}$	29.66	29.4
62.51	$1\frac{3}{4}$	28.74	28
51.79	2	27.12	26.6
44.21	$2\frac{1}{4}$	26.04	25.2
37.56	$2\frac{1}{2}$	22.56	23.8

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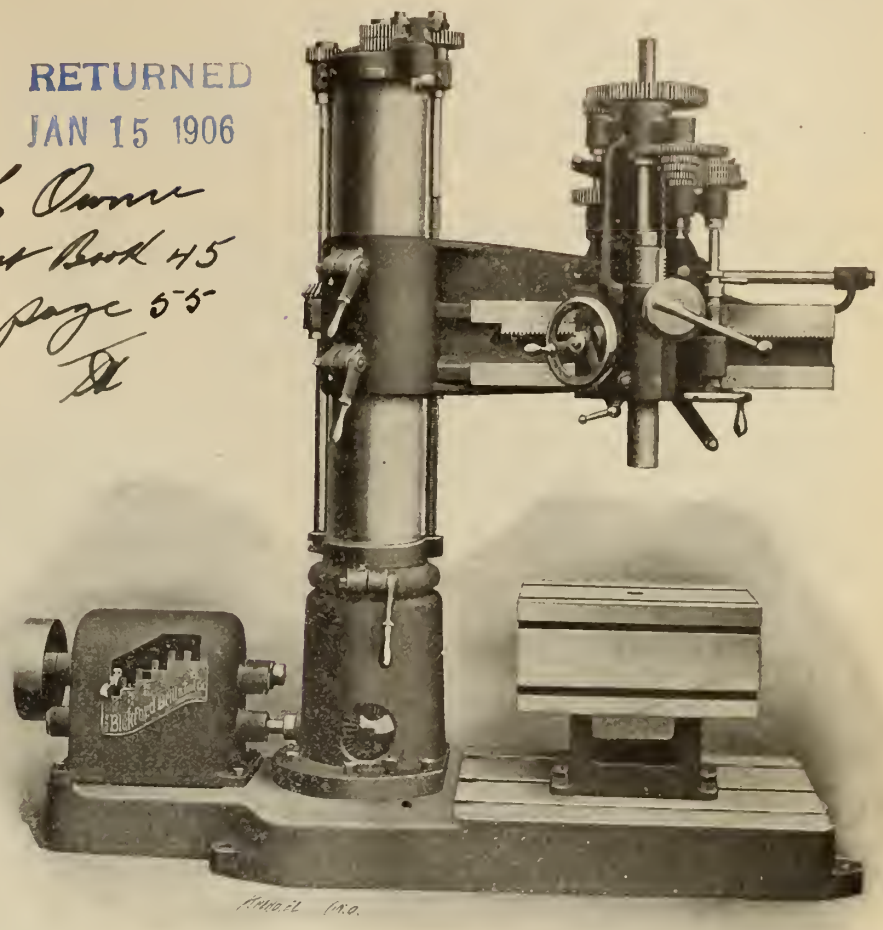
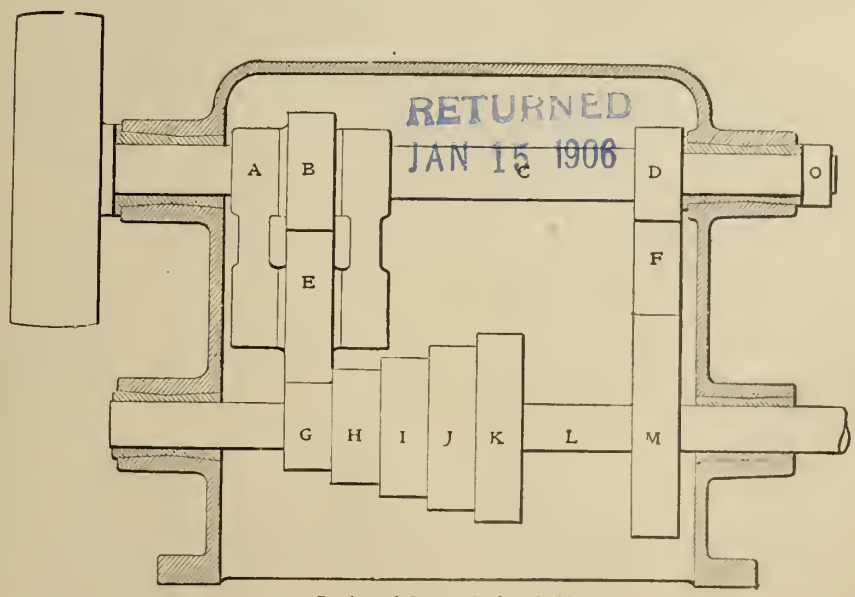
page 5-5-



3-ft. Bickford Radial Drill.



Section of Gear, Bickford Drill.

A comparison of the figures in the third and fourth columns indicates that the manufacturers have exercised their customary care of the selection of gears, as in no instance do the cutting speeds vary from the theoretically correct by more than .84 of a foot per minute. Another point to which our attention has been called is the irregular gradation of the speeds. The stock expression that "the speeds are in true geometrical progression" has become so common of late that many tool builders appear to think that no series other than a geometrical series is correct. That this is an erroneous belief is well exemplified in the example before us.

For the speeds to be in geometrical progression they would have to coincide with the following series of numbers :

Geometrical Series.	Diameter of Drills.	Periphery Speeds.
265.09	$\frac{1}{2}$	34.60
221.90	$\frac{5}{8}$	36.31
185.81	$\frac{3}{4}$	36.48
155.54	$\frac{7}{8}$	35.63
130.26	1	34.10
109.04	$1\frac{1}{8}$	32.12
91.31	$1\frac{1}{4}$	29.88
76.13	$1\frac{1}{2}$	30.01
64.00	$1\frac{3}{4}$	29.32
53.60	2	28.06
44.85	$2\frac{1}{4}$	26.41
37.56	$2\frac{1}{2}$	24.56

An inspection of the table will show that instead of giving a series of cutting speeds in which no speed is more than .84 of a foot too high, nor .87 of a foot too low, the cutting speeds in the geometrical series come "any-old way" from 2.88 feet too high to .92 of a foot too low. In the one case the maximum error is but 2.47 per cent., and the average error but .831 per

cent.; while in the other the maximum error is 8.57 per cent., and the average error 3.903 per cent., or more than four and one-half times greater.

The machine is also furnished with a five-step cone drive, a constant or variable speed motor drive, a swinging or swiveling table, and a round or double-end base.

A WONDERFUL DIGGER.

The country west of Montreal is being rapidly prepared for suburban residences, and roads are being opened up through many orchards and fields by a real estate company, which is exploiting this district. One of the most important factors in this process is a machine owned by the J. W. Harris Co., Limited, of Montreal, which is at present operating on the Upper Lachine road, just above the new G.T.R. roundhouse at Turcot.

This machine, which cuts a trench three feet wide and eight to thirteen feet deep, for water mains, carries the earth and stones back sixty feet, and refills the trench as quickly as men can lay the pipes. It has a long arm with a number of buckets or scoops revolving inward, which scoop up the earth, carry it up, and dump it on a moving table, which carries it back sixty feet and refills the drain. Or, if so desired, it can be adjusted to carry the earth to one side.

This machine is operated by a powerful sixty h.p. engine, is self-propelled, and can be moved from one place to another under its own steam, at the rate of three miles an hour. It can do the work of two hundred men, and experts who have seen the machine working pronounce it the greatest machine they ever witnessed.

UNIVERSAL MILLING MACHINES.

THIS machine, manufactured by the Becker-Brainard Milling Machine Co., embodies a number of new and important improvements which will be much appreciated by users of Universal milling machines. Special attention is called to the positive gear feed drive and the change feed mechanism, by which twenty changes of feed can be made without stopping the machine, the new clutch mechanism in connection with the hand wheels, also the box type of knee and telescopic elevating screw.

The spindle has a No. 10 B. & S. taper hole in front end, is made of hammered crucible steel, has a ¾ inch hole through its entire length and runs in self-centering bronze boxes arranged to compensate for wear. It has slot across end to engage clutch collar for arbor, is threaded to take a chuck, and a threaded collar covers the screw when not in use. It is connected with the change feed mechanism by three spur gears, making a positive drive. The spindle is fully back-geared, and gears are protected by guards. The arm is made of steel, is designed for horizontal adjustment and has an arbor support which may be removed, so that any of the attachments can be placed in position without the necessity of removing the arm. The table has an automatic longitudinal and cross feed in either direction and being centrally driven, feeds freely at any angle to 45 degrees right or left hand. It is provided with 3-5-8 inch T slots and with oil pans at each end. Feed is reversed in front of machine. The knee is of the box type and is supported by a telescopic elevating screw, so that no holes are necessary in the floor. Hand wheels are provided with clutch arrangement enclosed in hub which operate the vertical movement of the knee and cross movements of the carriage. When either the knee or carriage have been set to the required position, the clutch may be instantly disengaged by pressing in the knob on the front of the hand wheel, thereby preventing any accidental change from their fixed position and also preventing them from revolving when the automatic feeds are thrown in. Dials are adjustable and graduated to read to thousandths of an inch., to indicate the vertical, transverse and longitudinal movements of platen, and are set at any position with set screw. The patented change feed mechanism is conveniently arranged on the back of column and is capable of obtaining instantly, twenty changes of feed, slow or fast, by a simple movement of the lever, without stopping the machine.

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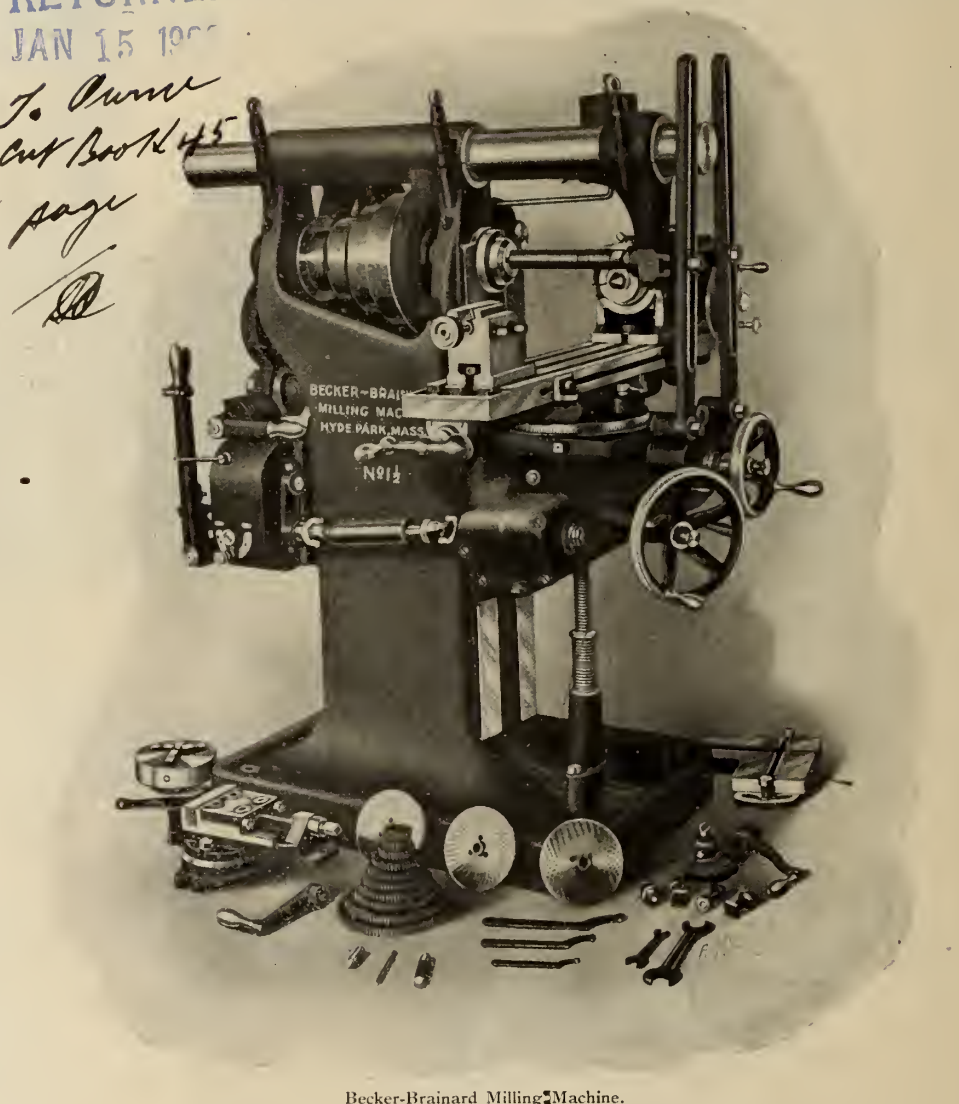


Becker-Brainard Milling Machine.

ONE'S POSSIBILITIES.

Insist on yourself; never imitate. There is at this moment for you an utterance brave and grand as that of the colossal chisel of Phidias, or the pen of Moses or Dante, but different from these. If you can hear what these patriarchs say, surely you can reply to them in the same pitch of voice.—Emerson.

WATER POWER OF THE OTTAWA.

On the Ottawa River there is at present available an enormous water power of which, generally speaking, little is known beyond the Chaudiere.

The Chaudiere is but one of the water powers of the Ottawa and but few realize the enormons extent of the power in water falls and rapids as the river approaches its source. At the Chaudiere there is a drop of 33 feet. Five miles above this is the Duchesne Falls with a drop of 12 to 14 feet, all the water of the Ottawa passing over it. At a distance of about 28 miles farther up, or 33 miles from Ottawa, is the Chats Falls, where there is a drop of at least twice that of the Chaudiere. Between Chats Falls and Mattawa there are half a dozen rapids. Other rapids above Mattawa are Le Cave with a drop of about 10 feet, then Les Arables 6 miles farther which have a drop of about 11 feet in half a mile. At Mountain Rapids 4 miles above Les Arables the river becomes very narrow and a drop of 12 feet takes place in such a short distance as to make it practically a fall. The last pitch in the Long Sault Rapid occurs 21 miles above Mountain Rapids, where there is a drop of 12 feet, the 5 miles above this being an almost continued succession of rapids. At the first pitch of the Long Sault there is 8 feet of a drop. At this point Lake Temiskaming starts and here Gordon Creek tumbles into the Ottawa at the first pitch of the Sault Rapids. Near by Temiskaming station is located. Gordon Creek runs from Lake Kippewa and in 9 miles drops 300 feet; in the first mile and a quarter there is 250 feet of a drop and although it is called Gordon Creek it is really a river of considerable volume. The next river emptying into Lake Temiskaming is Opimicon Creek, which though not large in volume drains numerous lakes, amongst which is Emerald over 3 miles long by half a mile wide. It has two falls close together which would total 100 feet. The mouth of the Opimicon Creek is 12 miles from Temiskaming station, 29 miles from which the Kippewa River enters the lake. Like Gordon Creek it also drains Lake Kippewa and has a fall of about 350 feet in rapids. On the west side of the lake, 38 miles from Temiskaming, the Montreal River enters through a narrow gorge, 13 to 16 feet in width. All that would be necessary to develop the water power here would be to cut a niche in the rock and put in stop logs. A head of 75 feet could easily be used, while at the same time there is a large volume of water available. Farther up is La Vallee Creek where one of its water powers is already developed, a saw mill being situated thereon. This is 43 miles from Temiskaming. Twenty-seven miles further up a small river, the Otter, runs into the lake near its head. On this there is a small water power developed. Coming to the headwaters of Lake Temiskaming we have the Quinze River (river of fifteen rapids). It flows from Lac des Quinze, a distance of 28 miles, during which there are 15 rapids. The first rapids drops 18 feet, almost a fall. There is a very large volume of water here, but the lease has already been given for this water power for pulp mills.

These constitute the falls of the Ottawa above the city itself, while immediately below is the Rideau, where the Rideau River drops 65 feet into the Ottawa. Then there is the Gatineau River whose headwaters are the same as those of the Ottawa, consequently the drop of the Gatineau must be the same, and therefore the water power will be in an equal ratio to their volumes. This gives the reader some idea of the possibilities for water power development in the vicinity of the Ottawa and there is no doubt that a few years will see industries in large numbers grouped about these centres of economical power.

The Metabechouan Falls, Quebec.

Companies Incorporated

The surrender of the charter of the W. G. Nott Bicycle Co., of Brantford, has been accepted.

Manitoba Peat Co., of Winnipeg, has been authorized to manufacture, sell and deal in peat and all kinds of fuel.

The Borland Carriage Co. have been granted the privilege of increasing their capital from $25,000 to $250,000.

Rhodes Metallic Packing Co., Toronto, share capital $40,000, purpose to deal in engineers' supplies. The directors are: J. M. Rhodes, J. S. Dawson and R. L. McAfee, all of Toronto.

Western Machine Co., Toronto, share capital $40,000, purpose to deal in all kinds of machinery. The directors to be: G. McLachlan, B. Thompson and W. T. Folliott, all of Toronto.

St. Mary's Hardware, St. Mary's, share capital $40,000, purpose to carry on a wholesale and retail hardware business. Directors: J. W. Peart, W. H. Bartlett and N. Mulloy, all of St. Mary's.

The Stephenson Belting Co., Toronto, share capital $40,000, purpose to deal in machinery, etc. The directors are: J. E. Stephenson, W. Stephenson, B. G. Stephenson, W. Gillespie and Mary Stephenson, all of Toronto.

Majestic Polishes, Toronto, share capital $40,000, purpose to manufacture, buy and sell oils, varnishes, paints, etc. The directors are: C. G. Armstrong, J. Hawken, D. R. Roy, T. H. Wilson and G. R. Brady, all of Toronto.

Toronto-Cobalt Mining, Toronto, share capital $300,000. purpose to carry on the operations of a mining, milling and development company. The directors are: H. B. Wills, W. Vandusen and J. S. Humberstone, all of Toronto.

The Eastern Coal Co. have been further incorporated to carry out and transact all matters and things comprised within the powers of the company. A. Alfred Laurie, Toronto, has been appointed attorney for the company.

Sovereign Cobalt Mining Co., Toronto. share capital $200,000, purpose to carry on the operations of a mining, milling and development company. The directors are: P. M. Horrocks, W. A. Smiley and F. J. Stanley, all of Toronto.

Petrolia Gas Co., Petrolia, share capital $40,000, purpose to manufacture and sell artificial and natural gas for all purposes. Directors: W. C. Noxon, E. Noxon and C. Swabey, of Toronto, and J. W. McCutcheon and B. McCutcheon, of Petrolia.

Schaake Machine Works, New Westminster, B.C., share capital $1,000,000, purpose to do general machine construction work. The directors are: Alex. Ewan, Henry Schaake, Dr. A. J. Holmes, Nels Nelson, and E. J. Fader, of New Westminster.

The Canadian De-Tinning & Chemical Co., Montreal, share capital $100,000, purpose to manufacture and deal in all kinds of chemicals and chemical products. The incorporators are H. H. Wolff, J. Wolff, A. Pollack, A. Bover, and H. J. Hague, all of Montreal.

The George Tucker Co., of Canada, Montreal, share capital $40,000, purpose to manufacture and deal in all kinds of stationery supplies and hardware sundries. The incorporators are J. H. Hough, W. H. Butters, F. R. Lanigan and H. Pillow, all of Montreal.

Economical Mfg. & Supply Co., Toronto; share capital $40,000; purpose, to manufacture and deal in engineers' and steam users' supplies. The directors are H. L. Brown, W. J. Boland, Samuel Behan and T. J. Walsh, all of Toronto, and W. H. Crow, of Welland.

Canadian Forty-Mile Dredging Co., Toronto, share capital $600,000, purpose to build, acquire, own, charter, navigate and use steam and other vessels. The incorporators are: J. S. Lowell, W. Bain, R. Gowans, E. W. McNeil, S. G. Crowell, W. F. Ralph, all of Toronto.

The Perry Lubricator & Machine Co., Ottawa, share capital $250,000, purpose to manufacture, buy, sell or deal in machinery or mechanical devices. The incorporators are J. Walker, A. Wilson and A. Berry of Montreal, and E. A. Bleakney, W. Gamble and F. A. Heney, of Ottawa.

The Twin City Brick & Supply Co., Port Arthur, share capital $40,000, purpose to manufacture, sell and dispose of cement and all kinds of bricks and building material. The directors are to be J. A. Stewart, H. Finger, E. McEwen, T. H. McCauley and J. McCutcheon, all of Port Arthur.

Imperial Electric Motor Co., Toronto, share capital $200,000, purpose to manufacture, sell, lease and dispose of power machinery and automobiles, etc. The directors are: A. Dods, R. McKay, G. Grant, Winnifred F. McIntosh, Agnes Elliott, A. E. Lyon and A. L. Bitzer, all of Toronto.

Stinson-Reeb Builders' Supply Co., Montreal, share capital $20,000, purpose to manufacture and deal in cement, lime, brick, stone, etc. The incorporators are: J. K. Stinson, F. J. Curran, and E. H. Stinson, of Montreal, J. A. Reeb, Port Colborne, and H. W. Macoomb. of Welland.

The Ontario Car Ferry Co., Montreal, share capital $500,000, purpose to carry on a general business in steamships, tugs, barges, ferry boats, etc. The incorporators are C. M. Hayes, F. H. Fitzhugh and J. W. Loud, of Montreal, and A. G. Yates, W. T. Nooman and R. W. Davis, of Rochester, N.Y.

Parker Foundry Co., Montreal, share capital $25,000, purpose to carry on the business of founders and manufacturers of castings, plumbers' supplies, machinery, etc. The incorporators are J. Ballantyne, H. W. Glassford, of Montreal, and M. C. Rosenfield, Cleveland, Ohio, W. J. White and A. W. P. Buchanan, of Montreal.

The Maritime Gasoline Engine & Supply Co. has been organized at Halifax, with a capital of $50,000, to deal in gasoline engines and power machinery. Agencies will be established in Newfoundland and the West Indies, as well as various places in the Maritime Provinces. Chas. Darlington, Halifax, is to be manager.

The Northumberland-Durham Power Co., Cobourg, share capital $250,000, purpose to construct, maintain, complete and operate works for the production of electricity for the purpose of light, heat and power. The directors are W. J. Crossen, W. J. Maher, F. M. Field, D. Ewing, T. C. Lapp, J. Henderson, A. R. Dundas, and E. C. S. Huycke, all of Cobourg, J. A. Culverwell, W. McLean, R. A. Mulholland, J. F. Clark and F. W. Galbraith, all of Port Hope, Charles Donnelly of Pittsburg, Pa., S. Nesbitt of Brighton, E. T. Adams, of Toronto, and R. A. Elliot, of Roseneath.

Millionaire Schwab's Views.

"In the next ten years," said Charles M. Schwab recently to a Manhattan professional man whom he was anxious to serve in return for invaluable assistance, "the new big fortunes will be made in mines. My advice to you is to watch out carefully and to get aboard at the earliest possible moment. To-day you can buy for $1 what will cost $5 in two years. I admit all you say of the outlook for railroads; but you must bear in mind that the roads get their money by carrying the industrial output. The two are inseparable. If one is to prosper it is because the other does."

Thus said the first president of the United States Steel Corporation, as he sat in his private car and ejected financial philosophy between the whiffs from an expensive cigar. The present gigantic operations by the "Pittsburg interests" in Nevada gold lands reflect his carefully considered policy; and it is not an accurate description of his mental state to call it a recent change of view brought about by men like John McKane, who is a Canadian, Donald Gillies, Albert S. Watson, Uri Curtis, Chris Zabriskie and George S. Nixon—the picturesque pioneers of the Tonopah region.

Machine Tools Wanted.

For the equipment of their new factory within the next few months the Massey-Harris Co., Limited, Toronto, will be in the market for a large number of machine tools and accessories. These will include not only regular machine tools, but many of special make. The superintendent of the works, Mr. Verity, is about to take a trip where he may see some of these special machines in operation. It is intended to install the best machinery obtainable. Operations formerly carried on by them in Stratford will be carried on in future in Toronto.

Stratford ratepayers will vote on a by-law on January 1st to grant certain inducements to a company to be organized by David Gilchrist of Toronto. The company propose to manufacture wooden boxes, and will invest $40,000 in building and machinery.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

A FREIGHT special of 28 cars took the machinery and stock of the Henry K. Wampole Co., manufacturing chemists, from Toronto to Perth last Friday. Nearly 200 men will be employed in the new works at Perth.

A new stave mill has been established at Brigden, Ont.

A soap factory is likely to be established at Berlin.

An extension is to be built to James Bros' foundry at Perth.

The Brantford Malleable Iron Works are to enlarge their works.

Calgary, Alta., has opened its new municipal electric light plant.

The Sommerville Paper Box Factory at Stratford is to be enlarged.

W. S. Dwinnell, Minneapolis, is to establish a saw mill at Strathcona, Alta.

J. K. Fleming, Hartland, N.B., is fitting up a lathe manufacturing plant.

A rich find of gold is reported from the Laurentian mine, near Wabigoon, Ont.

The Canada Glue Co. has changed its headquarters from Toronto to Brantford.

The White Bear Mine at Rossland is installing 400 horse-power electrical motor.

A nugget weighing 250 pounds of almost pure silver has been found at Cobalt.

The British North American Peat Fuel Company is to establish a factory at Winnipeg.

Work on the new Michigan Central Railway tunnel at Windsor has been commenced.

The town of Bracebridge has passed a by-law to spend $14,000 in extending its power plant.

Machine works are to be established at Dauphin, Man., by a company capitalized at $25,000.

A winding-up order has been made regarding the Carleton Foundry Co., of New Brunswick.

The Nipissing Foundry Co., of North Bay, have installed a dynamo to light their own plant.

The Morris Implement Co., Winnipeg, are to establish a branch and build a warehouse at Regina.

The Newville Lumber Co. are rebuilding near Parrsboro, N.S., which was recently destroyed by fire.

Machinery worth $15,000 is being installed at the Mackenzie & Mann iron mines at Atikokan.

Stonehouse & Schuman have began the manufacture of broom handles at Collingwood Corners, N.S.

The Maple Leaf Milling Co. contemplate building a mill between Keewatin and Kenora next Summer.

The Stark Electric Co. are endeavoring to purchase the electric light plant owned by the town of Paris.

In addition to a new depot at London the Grand Trunk are intending to build new freight sheds next Summer.

A new machine shop and other buildings are to be erected by the Dominion Coal Co. at Reserve Junction, C.B.

Moose Jaw's new waterworks system was opened a week ago. The town celebrated the event by a large banquet.

A. C. Thompson's iron foundry at Bridgewater, N.S., suffered damage by fire last week estimated at $23,000.

McGregor, Gourlay & Co., Galt, are advertising their factory building for sale, and may locate in another city.

The Galt Wagon Works Co. are to enlarge their plant. A site has been secured and new buildings are being planned.

The Goodison Threshing Machine Works at Sarnia were damaged to the extent of $10,000 by fire a few days ago.

Owing to a large increase in business the Canadian General Electric Co. are to erect a large warehouse at Montreal.

The town of Saskatoon is likely to be incorporated as a city and to install waterworks and electric lighting systems.

The Patent Roofing Company is being organized at Brantford, to establish a factory to manufacture roofing materials.

Mr. Hannah, a farmer at Griswold, Man., has purchased a site at Brandon and will erect a large hotel there next Summer.

Montreal coal dealers have announced that they will not raise their price above that now current in spite of advances in New York.

American capitalists have been looking for a manufacturing site for an iron industry, which may be established at Cobourg.

Victoria, B.C., is procuring estimates regarding the cost of a power house and machinery capable of generating 1,000 horse power.

Two large turbines are the result of this year's experiment by the Allan line. The plans for these new vessels are now being prepared.

The Amherst Foundry Co. have ordered from the Smart-Turner Machine Co., Limited, Hamilton, a single beam traveling crane.

Cambrian Mineral Co. is being organized for the purpose of erecting a smelter at Sudbury. The capital stock will be $100,000.

The Prepayment Meter Company, Peterboro, are to place orders immediately for machinery to manufacture their patented meters.

The Dominion Iron & Steel Co. has set in motion a new 850 horse power unit, which is the largest of its type in the Maritime Provinces.

The Massey-Harris Co. have closed their branch at Stratford, and will remove the plant to Toronto, in order to centralize their business.

The J. D. Duncan Milk Co. has purchased a site in Montreal, and will erect a three-storey brick and stone building, to cost $50,000.

The Government Diamond Drill now working at Cobalt has reached a depth of 340 feet and it is found that the rock is still rich in native ore.

A wireless telegraph station is being erected at Toronto Junction by the De Forest Co., and it is expected to be in working order early next year.

The B. C. Bedding and Upholstery Company, Vancouver, is to spend $50,000 on machinery and plant for the manufacture of iron and brass beds.

The B. C. Electric Railway Co. are to spend $36,000 for new rolling stock. All of the cars are being made at the company's shops at Vancouver.

The new Banwell-Hoxie Wire Fence Co. have installed their plant on Princess street, Hamilton. The new company is capitalized at $100,000.

Fire did considerable damage to the Granby Mining Company's crusher building at Phoenix, B.C., last Friday night. Arrangements have been made to ship from the old bins at Ironside until the crusher plant and buildings are reconstructed.

The Coal Creek coal mines, below Dawson City, will produce 4,000 tons of coal this Winter. The output will be hauled by the trains from the interior to the river and placed in the bunkers ready for shipment to Dawson early in the Spring.

A company to be capitalized at $4,500,000 is to be organized with headquarters at Dawson City, to install a gigantic hydraulic system for operating on the creeks tributary to Dawson. This is the largest mining proposition yet in the Klondike.

The Delaware & Hudson Railway Co. have purchased the Quebec Southern & South Shore Railway. The new company will spend a large sum in improvements and will compete actively in Southern Quebec with the Grand Trunk and Canadian Pacific.

Some of the firms who have recently placed orders with the Smart-Turner Machine Co., of Hamilton, for their standard duplex pump, include the Wilcox, Doolittle Co., the Port Hope Electric Light & Power Co., the Jenckes Machine Co. of Sherbrooke, the Hamilton Mountain Park Co., the Barrie Tanning Co., and the Marlatt & Armstrong Co.

The Alexander Brown Milling Co., Toronto, have taken out a permit for a flour mill to cost $40,000, to replace the one recently destroyed by fire.

Plans are being prepared for two business blocks to be erected at Fort William next year, to be erected by Messrs. Hitchcock & McGregor.

P. McCulloch, Hamilton, is to build two brick houses to cost $2,600; John Slater two more to cost $3,000, and Roy Isbestor one to cost $3,000.

The B. Greening Wire Co. have placed an order with the Smart-Turner Machine Co., Limited, Canada, for one of their single acting power pumps.

The Canada Cycle and Motor Company have started work on the erection of a brick building for manufacturing automobiles at Toronto Junction.

The C.P.R. is preparing to operate extensive coal fields near Hosmer, B.C. Owing to agreements productive work cannot be commenced until 1907.

W. A. Wilson, of the firm of Williams & Wilson, machinery merchants, has recovered from a severe attack of typhoid fever and is again at his business.

The Davis Tanning Co. propose to expend $50,000 in extending their plant if the city of Kingston will grant an exemption from taxation for twenty years.

Fire destroyed the car shop and blacksmith shop of the Prince Edward Island Railway at Charlottetown last Saturday, the damage amounting to $60,000.

The International Railway, Niagara Falls, has placed an order for 100 new cars to cost $600,000. The J. G. Brill Co., of Philadelphia, have secured the order.

Trim—Unless where otherwise specified, to be clear pine, spoon cleaned, and principal rooms to be for enamel finish (Harlequin ice cream)· a nice cream.

The Halifax Board of Trade is making vigorous efforts to secure Government assistance for the establishment of a steel ship building industry in Nova Scotia.

An electrical transmission line is to be constructed from Copper Cliff to the new Craighton mine, and a power house is to be erected for the electrical machinery.

F. B. Robins, has purchased 140 acres of land at Hamilton and proposes to dispose of part of it for manufacturing sites, and build residences on the remainder.

The open hearth steel furnace of the Dominion Iron & Steel Co. created a record one day last week, when the batter turned out 902 tons in twnety-four hours.

The Welland Board of Trade has endorsed the proposition that the town council purchase and operate an electric light plant and sell electric power to manufacturers.

A new nail works is to be established at St. John by Mr. Even Perkins, recently manager of the Maritime Nail Works, now controlled by the Capewell Horse Nail Co.

New Hampshire and Massachusetts capitalists have secured 30 square miles of timber lands in British Columbia, and will construct a large saw mill near Vancouver.

Ten tons of magnetic iron have been shipped to the "Soo" by the B. C. Mills, Timber & Trading Co. from its mines on Redonda Island, eighty miles from Vancouver.

The Canadian Pacific Railway Co. has spent $64,500 in building operations this year at Calgary. Large new freight sheds to cost $28,000 are also planned for construction.

Fire did damage to the extent of $5,000 in the premises of R. H. Buchanan & Co., machinery contractors, 234 Craig street, Montreal, in the early· morning of December 14 last.

The Dominion Iron & Steel Company has chartered the big Swedish steamer Drottning Sophia to engage in next season's iron ore trade from Wabana, Newfoundland.

A number of Montreal capitalists are applying for incorporation under the name of the Dominion Steel Car Co., Limited, to manufacture cars and all their component parts.

The Manitoba Iron Works, Limited, Winnipeg, have secured the contract for the new well caisson for that city. Heretofore these contracts have gone to eastern manufacturers.

London and Stratford capitalists propose to erect an abattoir near the city of London, providing certain privileges are given the company, which will be capitalized at $125,000.

Portage la Prairie is to vote on the question of granting inducement to the London Wire Fence & Machine Co., who propose to erect a $30,000 factory in the west end of the city.

The Peacock File Co. have definitely decided to locate in Welland. The company have $5,000 worth of machinery at Buffalo which they desire to bring into Canada free of duty.

A $50,000 steel and concrete bridge will be erected over the Bow River at Calgary, by the Alberta Government. A Normal School, to cost $60,000, will also be erected at Calgary.

The Le Roi amalgamation scheme is not to go through according to cable reports of a meeting of the shareholders at London, Eng., last week. The decision means much to Rossland.

The B. F. Sturtevant Co., Boston, been awarded the contract of heating and ventilating the large new factory of the Fairbanks-Morse Co., Toronto.

The Huron & Ontario Electric Railway, which has expended $100,000 in construction work is said to intend to open up a line next Summer from Walkerton to Meaford and Owen Sound.

W. K. Vanderbilt inspected the Ontario Power Company's plant at Niagara Falls this week, the New York Central having decided to electrify their railway lines in Western New York.

J. S. Stevenson, Pittsburgh, has placed an order for a steamship with triple expansion engines. It will be used on the Muskoka Lakes, and will be one of the finest ever turned out at Kingston.

Two by-laws have been carried at Winnipeg, one being to grant $150,000 to the hospital and the other authorizing the expenditure of $650,000 in building and equiping a municipal gas plant.

The Nova Scotia Steel & Coal Co is making preparation to open a new colliery at Sydney Mines, N.S. The company also intend to install an electrical plant to develop power for their mine.

The Grand Trunk Railway Co. have announced that they intend to spend $6,000,000 on a new station, to be erected in Montreal. The tracks are to be elevated and other improvements made.

Roofing — Material to be haunch of venison, made secure with good roofing composition of red current jelly. Watercress. To be rendered weatherproof by a thorough application of best mastic-(ation).

The Chapman Double Ball Bearing Co., Toronto, have received the contract for the equipment of the new plant of the Meaford Wheelbarrow Co., at Meaford, Ont., with their double ball bearings.

The report of the building done at Hamilton in the month of November shows a wonderful increase as compared with November last year. The figures are: November, 1905, $395,625; November, 1904, $68,200; an increase of $327,425.

Operations have commenced on the new factory of the Ingersoll Nut Co. Some of the machinery has not yet been installed, but the manufacture of cold punched nuts will be carried on from this time.

Canadian manufacturers are said to be inquiring in the English markets for supplies of steel strips for tube making, claiming that they are not able to obtain sufficient supplies of this material in America.

The Canadian Smelting Works at Trail has blown in its fourth copper furnace, this giving the plant a capacity of 1,000 tons of copper per day. The lead refinery is turning out 50 tons of pig lead daily.

The rail mill of the Dominion Iron & Steel Company is again in operation, having undergone temporary repairs. A new engine head, which has been ordered from Cleveland, Ohio, will be in Sydney in a few days.

Joisting—Bread and butter rolls. To be laid on bond timbers and properly bridged, and to be covered diagonally with butter (nut), knots less than 1½ inch allowed. Hair joints will not be required in this flooring.

The New York Central Railway has purchased the proposed new North Lanark Railway, which will have its starting point from Ottawa and the terminus at Madawaska, with branches to Arnprior and Fitzroy Harbor.

The Winnipeg Electric Power Company have constructed towers every 500 feet for the 62 miles between their power plant and Winnipeg. Another power company is installing a power plant on the Winnipeg River at Silver Falls.

The Eastern Coal Company, at Amherst, N.S., are to equip the mine with the most up-to-date machinery capable of turning out at least three to five hundred tons per day. There had already been upwards of 40,000 tons of coal taken out when the old slope was worked.

A new company is being organized to establish a carbide industry in Canada. Plants are to be erected at Fernie, B. C., and at certain points in Ontario and Quebec. The company will have a capital of $250,000, and it is expected the price of carbide will be reduced from $70 to $50 per ton.

Many mineral discoveries have been made in the Lake St. John district in Northern Quebec. Gold, copper, asbestos and nickel have all been discovered in considerable quantities, and a United States steel corporation has acquired several properties which they intend to develop later on.

Several industrial concerns are negotiating with the town of Fort William regarding establishing factories at that place. Amongst these are a wagon manufacturing company, a cast iron pipe foundry, a nail mill, large iron works for manufacture of bar and rod iron and a rolling mill for rails.

A copper smelter is to be established at Bruce Mines to treat the ores from the property recently purchased by the English syndicate. It is said that the syndicate will employ 500 men and endeavor to develop the Bruce Mines so that an output of 500 tons of copper per day will be possible.

Mr. Karnoch, chief engineer of the Canadian General Electric Co., Toronto, was inMontreal on December 12 to witness the testing of turbines supplied by his firm to the Canada Car Co., Limited. He was accompanied by Mr. F. C. Smallpiece, of the Peterborough engineering department of the same firm.

The Canada Cordage Flax Co., which has decided to locate at Glencoe, will expend $75,000 on building and machinery and will employ 90 men the first year. The town will submit a by-law guaranteeing the honds of the company to the amount of $40,000, provide a free site and give other advantages.

Thos. G. Anderson, formerly of Peterborough, has shown considerable enterprise in establishing the Hamilton Pattern Works, and is now located at 134 Bay street north, Hamilton, Ont. This firm make patterns for iron, steel and brass castings; metal patterns, and make a specialty of difficult core work.

The Atlantic Grind Stone, Coal and Railway Co's. properties near Amherst, N.S., are to be still further developed. A new reef of superior grind stone has been uncovered and additional machinery is being installed. New buildings and machinery have also been erected in order to increase the output of the coal mine.

The Chapman Double Ball Bearing Co., Toronto, report a steady increase in the demand for their goods, and state that a very large part of their bearings go to replace the old style, self-oiling journal bearings, which have been discarded, owing to the heavy loss of power which is caused by these journal bearings.

The Montreal Builders' Exchange had a right good time at the banquet held recently the success of which was largely due to the efforts of President N. T. Gagnon and Vice-President E. M. Roberts. The feature of the evening was a most cleverly prepared menu card, entitled "Specifications."

Heintzman & Co., Toronto, have purchased a site on Yonge street, where McDonald & Willson's stove store now stands, and will erect a ten-storey building, which they will use as piano warerooms. The site cost $120,000, being at the rate of $3,000 per foot. McDonald & Willson have the right to remain in their present store for three years longer.

The Volta Electric Co., finding their premises too small to take care of a growing business, have moved from 86 to 88 Adelaide street west, Toronto. A new front is being put in the premises, and bright and attractive quarters will be the result. Hitherto their office was overhead, but it is possible with the new arrangments to have the office on the ground floor.

W. H. Banfield & Sons, Adelaide street west, Toronto, are about to more than double the capacity of their plant. A rapidly growing business has necessitated this. At the rear of the present works a two-storey addition has been made and the machinery installed therein. This latest move should give the firm of Banfield & Sons a better opportunity to keep up with their numerous orders.

The rise in lead has been so marked as to stop payments of the bounty given by the Dominion Government. It was paid on a sliding scale, which reduced the bounty as the price rose. Just now the price is so high that the bounty is nil. As salmon canners have to make preparation almost a year in advance for their supplies of lead, tin and tin plate, the belated ones are hit hard by the high prices.

Within the past two months Allis-Chalmers-Bullock, Limited, have made contracts for the electrical equipment of the Keewatin Flour Mills Co., Keewatin; the Ogilvie Flour Mills Co., Fort William, and the Western Canada Flour Mills Co., St. Boniface, aggregating 4,000 h.p. The motors range from 500 h.p. downwards. The entire equipment is under construction at the shops in Montreal.

The first of two lunch rooms, each to accommodate 350 men at a sitting, has just been opened at the Angus shops of the Canadian Pacific Railway. It is the intention to provide meals at bare cost price, or to heat up food which the men may bring from home. As there are between four and five thousand men employed at these shops, the seating capacity is expected to be taxed to its utmost capacity.

The C.P.R. has announced its plans for railway construction on Vancouver Island for next year. The extension of the E. & N. Railway, now owned by the C.P.R., through Comox to Campbell River, near the north end of the island, is proposed, and a branch from Duncan's via the Cowichan Valley to Alberni on the west coast of the island is another extension for which power to construct will be sought.

There are now fifteen members on the Granby board of directors, those newly elected being George Crawford Clark, Sanford H. Steel, and Edwin Thorne. Application has been made to the Legislative Assembly of British Columbia to change the par value of the stock from $10 to $100 a share, thus reducing the number of shares. A dividend of 3 per cent. has been declared on the capital stock out of the net earnings.

The machine room of the Piedmont Paper Co., Piedmont, N.Y., containing over half a million cubic feet of space, is to be ventilated by apparatus furnished by B. F. Sturtevant Co., Boston, Mass. This will consist of an engine-driven fan with heater, and a system of distributing pipe which permits of so discharging the warm air as to instantly absorb the moisture in the atmosphere and keep it perfectly clear.

The Collingwood Shipbuilding Co. has closed contract for the construction of two steel steamers. The contract price for the two is about $400,000. One is to be built for James Playfair, Midland, being 486 feet in length and having a carrying capacity of 323,000 bushels of wheat. The other is for the Montreal Transportation Co., it being for a barge 206 feet in length. About 700 men will be employed building the boats.

The town council of Westmount, P.Q., is considering a new building by-law which, if it goes into effect, will make it unlawful for any person to build, have or maintain any dwelling house which occupies more than two-thirds of the building lot on which it is erected, to construct in such building any sleeping room which is less than 640 cubic feet in dimension, and which does not possess direct communication by window with the out-of-doors.

Toronto capitalists have acquired the Brantford Street Railway, the Grand Valley Railway between Paris and Brantford, and the Woodstock, Thames Valley & Ingersoll Railway running between Woodstock and Ingersoll. Among those interested in the purchase are A. J. Pattison, W. S. Dinnick and John Firstbrook. Some of the stock will still be retained by people in Brantford. The roads will be greatly improved and the lines extended.

Crawford Bay, on Kootenay Lake, the site of a former smelter proposition, is to be the scene of activity in the first development of the iron industry in the interior of B.C. A syndicate of Cleveland, Ohio, capitalists, headed by Matthias Horsling, has bought the iron mines owned by Nelson people, in that vicinity and a plant is to be built next Spring. A mono-rail road is to be laid for carrying the ore to Crawford Bay from the mines.

An alliance of great benefit to the "Soo" industries has been formed between the Lake Superior Corporation and the Canadian Pacific Railway. The big railway is now getting over $100,000 a month for hauling the business of the different subsidiary companies of the Lake Superior Corporation. In return, the Canadian Pacific has become the largest and one of the most profitable

eustomers of the steel rail mill of the Algoma Steel Company.

The Great Northern Railway has issued a new lumber tariff effective on the new branch line to Fernie and on the Nelson-Waneta branch to Winnipeg and and a number of other Manitoba towns. The new rate is 33 cents per hundr?d, a saving of between 60c and $1 per foot over the old rates. Formerly the trade from the Nelson branch paid a 5-cent local rate to Nelson, and the C.P.R. carried the lumber east from that point at its regular tariff.

The Stuart Machinery Co., of Winnipeg, have suffered the destruction of about twenty-five feet of their machine shop by fire recently. Although considerably hampered they resumed work shortly after. The damage consists chiefly through the repair shop, where they had a large number of parts of engines in for repairs, which will be hard to replace. A number of motors and armatures stored above the machine shop were also totally destroyed.

The report of the building inspector of Montreal as to building operations in the city and vicinity shows that seventy-seven permits for new buildings were issued during the month of November, the cost of the structures being $313,645. Permits for alterations numbered twenty and involved an amount of $26,871. This made a total amount invested in building operations last month of $340,576, an increase over the corresponding month of last year of $105,611.

Coal shipments to the St. Lawrence from Cape Breton this year are the largest on record, 1,121,008 tons having been shipped by the Dominion Coal Company alone from Sydney. A few years ago the entire Cape Breton output was little more than this. It is expected that the Dominion Coal Company's output for the year will amount to well over three million tons, while the output from the other mines will hring the Cape Breton total up to 4,000,000.

Vancouver City Council proposes submitting money by-laws to the ratepayers at the coming civic elections, for works and improvements totalling nearly a million dollars. The chief item is that providing for waterworks extension, including the establishment of a high level service, which means practically a new system. This will cost $750,000, and construction will cover three years. The other hy-laws are for schools, sewers and streets. In 1905 money by-laws totalling some $600,000 were voted on and carried.

The British Columbia Telephone Co., operating plants in all the chief cities of the province, announce the immediate construction of a fine three-storey brick block in this city, to be used as a central office. In this a modern switchboard of large capacity is to be installed, the cost heing estimated at over $100,000 for the switchhoard alone. The first installation will be for 4,000 pairs of direct wires, while with addition of sections the capacity can be raised to accommodate from 13,000 to 14,000 subscribers.

Another new industry that will give employment to a large number of hands is now being estahlished in Vancouver, and will be in full running order in a few weeks. At an expenditure of nearly $50,000 a new can factory and sheet metal works is being installed bv the A. M. Forbes Hardware Company in a large new factory on Seymour street, which is now receiving its finishing touches. The factory is a commodious four-storey frame building, located on the west side of Seymour street.

The Standard Bolt & Serew Co. has fitted up a large plant at the corner of Sorauren avenue and Dundas street, Toronto. The equipment is entirely new and up-to-date in every partieular. This firm intends manufaeturing on a large seale bolts of all kinds, ineluding carriage, railroad traek bolts, nuts, cap screws, set screws, studs, ete. The proeess of manufaeture is well under way. A new building is being erected nearby for the manufacture of drop forgings, a line this firm intends to go into on a large scale.

It is understood that the Grand Trunk has let the contract for the equipment of the Port Huron-Sarnia tunnel with electrie power for the operation of trains. The contract involves the building of large power houses in Port Huron and Sarnia, and the total eost is said to be nearly $700,000. The third rail system and powerful eleetric locomotives will be used. The adoption of eleetricity will remove all danger from gas in the tunnel. The eompany has been working on plans for this improvement for three years.

New Westminster is not satisfied with merely recovering her long lost prestige as a deep-sea port, which was effected this month by the arrival of the British ship Wethersfield to load lumber at the Fraser River Saw Mills, some miles above the city: The Roval City now seeks to establish a ship-building industry, the object being to secure Dominion aid hy way of honus per ton on all steel ships constructed there. The appeal of the Halifax Board of Trade for endorsation of their petition to the same effect, set the Royal citizens thinking.

The 30-stall roundhouse of the Intercolonial Railway, Truro, N.S., is being equipped by the B. F. Sturtevant Co., Boston, Mass., with a complete heating and ventilating system especially designed for the rapid thawing out of engines. An induced draft apparatus is also being furnished for the boiler plant.

The St. Denis boulevard ear barns of the Montreal Street Railwav Co. are being equipped by the B. F. Sturtevant Co., Boston, Mass., with two complete heating apparatus and an indueed draft apparatus for the boiler plant.

Owing to the increase of business and the growing importance of Montreal as a centre for distribution of their products, the Robb Engineering Co., Amherst, N.S., have decided to change their agency at Montreal into a branch office. Mr Watson Jack has been appointed manager, and Mr. Allister McLean will continue in the capacity of engineer for the Montreal district. The Robb Engineering Co. will have their quarters in the suite of offices occupied by Messrs. Watson Jack & Co., in the Bell Telephone building, corner of Notre Dame and St. John street.

The C.P.R. have decided to relay with new steel next year the entire Crow's Nest Pass line from Lethbridge to Kootenay Landing, a distance of 211 miles. The total contemplated improvements will cost $1,250,000. Each mile will take about 125 tons of rails, or say 26,375 tons for the entire distance. Each ton of rails will cost (exclusive of freight) $33, or $869,275. Labor will eost about $120,000, and the ballasting of the road for the new rails will mean an outlay of $211,000. Extra expenses of one kind or another will exhaust the appropriation of $1,250,000.

Across the inlet from Vancouver a new eity is soon to be born. The North Vancouver rural district is to be divided, and the portion on the waterfront, already being developed as a townsite, is to secure civic life. The expected advent of a railway will give impulse to the city now in process of organization. An agreement has been made with the municipality as it now exists for the installation of street car lines. Some six miles are to be constructed early in the Spring, plans for the work having beens approved by both the municipality and the B. C. Electric Railway Company.

By the success of A. J. McMillan, formerly managing director of the Le Roi mine at Rossland, in being returned to office after having been voted out at a previous meeting of the directors in London, marked changes are to take place at the mining city. The Le Roi is to be deepened and the ore which has been of late going to the big C. P. R. smelter at Trail is to be shipped to the Le Roi's smelter at Northport. Wash., which has of late been shut down. This smelter is owned by the Le Roi Company, and is located just across the international boundary in the State of Washington.

The ground floor of the new factory will be devoted to one of the largest tin and sheet metal works in the province, giving steady employment to about twenty-five hands. The second floor will be devoted to a corniee and roofing establishment, also employing a considerable number of hands, while the can factorv, when in full swing on the large orders which the firm has already booked, will give employment to about fiftv skilled eanmakers. Altogether nearlv a hundred men will be engaged in this new industry. This factory is an entirely separate institution from the firm's business on Hastings street.

Among recent contracts for heating and ventilating equipment placed with the B. F. Sturtevant Co., Boston, Mass., are included those for the National Tube Co., McKeesport, Pa., for rolling mills and machine shop, containing over 1,000,000 cubic feet of space; for the Fairbanks-Morse Canadian Mfg. Co., Toronto, Ont., including separate apparatus for machine shop, blacksmith shop and foundry; for Brown & Sharpe Mfg. Co., Providenee, R.I.; for Pressed Steel Car Co., Mc Kee's Rocks, Pa., for ear paint shop containing nearly 4,000,000 eubic feet of space; and for a similar shop containing over 2,500,000 cubic feet at the Allegheny, Pa., plant of the same company.

With another month yet to run, the cost of building operations in Winnipeg

this year is within a quarter of a million of the $10,000,000 mark. The number of permits and the value of buildings for which permits were given during the month of November greatly exceed the figures of the same month last year. Following are the statistics: Value of buildings, January 1 to November 30, 1904, $5,640,110; 1905, $9,743,560. Value of buildings for month of November, 1904, $471,590; 1905, $788,771. Number of building permits issued January 1 to November 30, 1904, 1,742; 1905, 2,569. Number of buildings for which permits were issued for month of November, 1904, 156; 1905, 238. Number of new buildings erected from January 1 to November 30, 1904, 1,620; 1905, 2,933.

Following the annual meeting of the Pacific Coast Lumbermen's Association, held at Tacoma on Tuesday, 12th inst., it is announced that a decision had been reached to raise the price of lumber to a $13 base, to go into effect at once, and to prepare a list on a base of $15, to be effective February 1. This will chiefly affect export cargo trade, but it is noticeable that in local circles the rumor is current that a meeting of the local association is likely to be called ere long to discuss prices for local consumption as well as for export east. The shortage of logs at this season is having some effect on lumber conditions. Another point is brought up, that the continuation of the boycott by local merchants will have the effect of making a car shortage which will adversely reflect on the lumber trade.

There is talk of the starting of a steel rail mill in the Kootenay district of British Columbia. It is said that the iron mines, owned by G. B. McMillan and R. Robinson, of Nelson, on Crawford Creek, have been sold to a syndicate of Cleveland and St. Paul capitalists, headed by Matthias Horsling of Cleveland. The purchase price is in the neighborhood of $75,000, and the new owners will begin active operations on June 1 next. Their plans include the construction of a mono-rail line from the mines to Crawford Bay. The new properties will be operated in connection with steel works already in existence, either at the coast or in the east. The company propose to expend $150,000 next Summer in putting in rolls, and providing transportation facilities between the mines and the lake shore.

Conditions which are rapidly driving large manufacturing interests from the United States to Canada are to be considered within a few days by the Illinois Manufacturers' Association. Reports just gathered show that 132 of the leading concerns of the country have been obliged, chiefly on account to tariff restriction, to establish branch plants in Canada. The resulting loss financially is estimated at upwards of $50,000,000. The agitation which the Illinois manufacturers are about to start is expected to assume the form of a national appeal to Congress. The remedy most in favor locally and throughout the country provides for reciprocity legislation which will permit of a freer exchange of American and Canadian manufactured products. It is likely that Congress will be asked during the present Session to take some steps in this direction.

Canada's imports reach the total of $251,603,000, or twenty-five per cent. of the United States' total imports. Canada, with one-fourteenth of the population of the United States, is only quadrupled by that country in the value and volume of her imports. For every $2.50 worth of imported goods consumed in Canada, 70 cents' worth of imported goods are consumed in the United States. The meaning of this difference is that Canada should manufacture more and import less. Canada is not superior to the United States as a consumer of goods, domestic or manufactured. The United States is superior to Canada in manufacturing to supply her own needs instead of having to import. Canada should increase her manufactures and decrease her importations, especially at the expense of the United States, which supplied $152,431,626 of our importations, or 60.58 of the total.

One measure of the development and peopling of the northwest may be found in the erection there of flour mills to meet the local as well as the export demand for flour. The Western Canada Flour Mills Co., which has already a mill at Brandon as well as at Goderich, is now erecting another of the great capacity of 4,000 barrels per day at Winnipeg. In order to have their flour mill up-to-date in every particular, the company will operate by electricity, and has just awarded the contract for the necessary equipment to Allis-Chalmers-Bullock, Limited, of Montreal. This contract includes two synchronous motors of 500 horse power capacity each, and a number of smaller motors, which, ranging from 5 h.p. to 200 h.p., aggregate 750 h.p. It also includes switchboards, transformers and accessories. The mill, which was designed by Mr. R. J. Megaw, will be of the most modern type and the electric equipment necessary makes one of the largest orders for this class of work ever given in America.

The Westinghouse Electrical & Mfg. Co. are furnishing equipments for an unusually large number of industrial power plants of a diversified character. Owing to the magnitude of the works of the Westinghouse Electric & Mfg. Co., at Pittsburgh, a great many people have received an erroneous impression that the product of this company consisted principally of only the larger types of electrical apparatus, especially so with reference to electrical generating units. This wrong impression is largely due to the fact that many of the great power plants of the country, having the largest units, are equipped with Westinghouse generators and auxiliary apparatus. The aggregate business of this company, however, in the smaller units, far exceeds that of the larger and special types. They manufacture every kind of electrical apparatus for either light or heavy work, and their instruments for measuring electrical energy equal in delicate construction the works of the better class of modern watches. These instruments are recognized standards in their field.

The Montreal Street Railway Co., Montreal, have awarded the contract for their new car barns to the Canadian White Co., Montreal. Each of the sheds will be 202 feet long, 140 feet wide, and 17 feet 4 inches high, from top of floor to underside of beam, each having a capacity of 48 cars, 50 feet long over all. The foundations will be of concrete. The walls and piers are also to be of concrete, with foundation bolts built in them. The walls of the buildings are to be of sound, plastic, hard-burned brick. The floors will be nine inches concrete laid on the levelled surface of the ground pitched to gutters, with a finishing layer one inch thick trowelled to a smooth and level surface. The construction of the iron work will be all riveted; load assumed for roof being 75 pounds. The doors will be adapted to the requirements of a street railway, and operated by hand. The heating will be by the fan system of hot air, and of a capacity to change the air four times an hour and to heat the building to 70 degrees F. in zero weather. Steam will be furnished by two horizontal tubular boilers and furnished with induced draft fans. A feature in connection with these new sheds will be that the flooring between the tracks in the front part of the sheds will be lowered 18 inches below level of rail, to facilitate the examination of trucks, etc., without jacking up of cars.

Cement Mill May Move.

The next meeting of the National Portland Cement Company's shareholders promises to be an interesting one. The directors of the company have recommended the removal of the company's mill from Durham, Ont., on account of the scarcity of raw material in that locality. The town council of Durham disputes the statement that material is scarce, and a committee appointed by it, under the chairmanship of Dr. Jamieson, M.P.P., investigated the question, and reports that there is a sufficient quantity of marl obtainable to keep a cement mill running for a man's lifetime.

The company was capitalized at one million dollars, a quarter of a million of which went to the promoters. A mill was constructed with a capacity of 1,000 barrels a day, and said to be one of the best mills on the continent. In the building of it, however, a liability was incurred, which was increased by inexperience of workmen and accidents during the first year. No dividends being forthcoming, the stock fell to 16 cents on the dollar.

This last year things went very much better, and the company was enabled to pay back $13,000 which had been borrowed from the bank, and to reduce the indebtedness from $127,000 to $30,000. On the ton of this favorable report the citizens of Durham, who are largely interested in the company, were thrown into consternation by the resolution of the directors to move the plant elsewhere.

Economy in Steam Power.

On this subject Professor R. J. Durley, of McGill University, read a very interesting paper before the Canadian Railway Club at their last monthly meeting.

In the course of his remarks Professor Durley said that although there is a great future before the gas engine as a source of power, the time has not quite arrived when it can be looked upon as a commercial competitor with the steam engine or turbine, under any but exceptional circumstances. At the present time a producer gas plant for anthra-

cite coal, with gas engines and generators, will cost in Canada about 20 per cent. more than a steam plant to take the same peak load. The cost for fuel at high load factors is considerably less for the gas plant, but this saving is much smaller at low load factors, on account of the higher fixed charges.

Dealing with engine room costs, Prof. Durley claimed that engineers on this side of the Atlantic had been somewhat slow to realize the very excellent results which had been and were being obtained in Europe from the use of superheated steam. The installation of heaters was, however, coming more and more into favor in Canada.

In conclusion the speaker referred to the cost of labor in the engine room. This depends, he said, not only on the type of motive power adopted, but also very largely on the arrangement of the machinery in the engine room, and especially on the amount and complexity of the auxiliary machinery installed.

Ontario Mining Conference.

An important event in the annals of mining development in Ontario took place in Toronto, Tuesday to Friday, December 12 to 15, when delegates from the different mining centres of the province met in conference at the Parliament buildings at the instigation of the Government. Mr. W. D. McPherson, K. C., was elected chairman and presided at the different meetings. At the first meeting the subject of royalty was discussed and a resolution opposing the paying of any royalty was unanimously adopted. Another resolution carried was "that there should be only one mining law for the whole of the province." Prospectors' rights were discussed and a resolution that carried unanimously passed to the effect that prospectors were to be given a title to claims discovered in timber limits, after which the owner of such limit was to be given three years to remove the timber therefrom. Recording districts were deemed advisable and a resolution to this effect adopted. All Wednesday morning and most of the afternoon was taken up with a debate on the resolution: "That any licensee may stake out a location without first making a discovery of mineral thereon." The prolonged discussion ended in the amendment as follows: "That any licensee may stake out a location without first making a discovery of mineral thereon under stringent working conditions to be decided by the meeting." Other resolutions carried were: "That all locations shall be recorded within fifteen days after staking, if within ten miles from recording office, one day additional being allowed for each additional five miles." "That during the period between staking and recording the claim the licensee first staking shall be entitled to full possession and preservation of his rights." "That locations shall consist of 40 acres except in cases of fractional locations. In surveyed territory locations should consist of a fractional part of a lot." The situation regarding the mining claims on the Gillies timber limits was reviewed on Thursday, but the resolutions and amendments thereon were considered unsatisfactory. It was generally admitted that this would be the most difficult question with which the Government will have to deal. Resolutions passed were: "That the Department of Lands and Mines be divided into two departments, one to be known as the Crown Lands Department, the other as the Department of Mines, each with a minister at its head. That all mining partnerships be recorded in the recording office in which the mining claim is registered, and a simple method for the registration, dissolution and enforcement of other rights of the partnership be provided. That the Ontario Government grant to the ore-producer a bounty for the production of pig iron by Ontario furnaces when such iron is made wholly from Ontario ores. That although it is desirable that assistance be given by the Dominion Government in the way of bounties on pig iron smelted in the Dominion, the convention protests against the present system of bounties on iron smelted from foreign ores, and asks that the same be discontinued when the present law expires in June, 1907, but that the bounty on pig iron made from domestic ore be placed at $3 per ton for the next five years. That the Province of Ontario should erect a smelter and refinery capable of refining the silver-cohalt ores, and should make provision for refining the copper and nickel ores of the province. That the Dominion Government be recommended to admit coal free of duty, if used to make coke to be used for the smelting or treatment of iron ore. That the price of mining lands throughout the province be uniform, namely, $2.50 per acre in surveyed and $2 in unsurveyed territory. That a license be required to expend $100 in actual mining work during 90 days succeeding his application, excluding from the computation November, December, January, February, March, April, and a similar amount during three succeeding years, or prior thereto, such expenditure to be computed at the rate of $3 for each day's work performed by a grown man. Affidavit of expenditure to be filed with the recorder within 30 days after the time allowed for each expenditure. For every adjoining five locations or less held by one or more licensees and which are principally valuable for base metals, all such development operations may be carried on upon one or more of the locations." On Friday resolutions were adopted as follows: "That it would be advisable for the Ontario legislature to offer prizes for the demonstration of satisfactory methods for the treatment of refractory ores. That the Government should procure expert evidence as to the advisability of fully testing the Thunder Bay silver district. That an applicant for a mining location shall at the expiration of the time for his development work file with the recorder at least two affidavits of practical miners that he has complied with the regulations, otherwise the claims shall be considered abandoned. That the law giving township councils ownership of mineral on concession and side lines be abolished, and the mineral thereon being bargained for direct with the Crown Lands Department, the same title to be issued as is issued for the adjoining land. No licensee shall stake out or apply for more than two mining locations principally valuable for precious metals, or more than four locations principally valuable for base metals, within a radius of six miles thereof during any one calendar year, either in his own name or in the name of any other licensee." In the afternoon a deputation waited on Hon. Mr. Cochrane, Minister of Lands and Mines, and presented to him the resolutions adopted by the conference.

PERSONAL MENTION.

The death occurred very suddenly recently of Mr. J. B. Jackson, for many years registrar of copyrights and trade marks in the Department of Agriculture. Owing to his broad technical knowledge and long experience, Mr. Jackson was admirably fitted for this position and his loss will be keenly felt in the department. He was 59 years of age and leaves a widow, one son and three daughters.

* * *

A prominent mining capitalist and expert on mining affairs, Mr. Geo. G. Blackwell, of Liverpool, Eng., has recently completed a somewhat extensive tour of Canada and the United States. Mr. Blackwell thinks that mineral prospects in Canada are very gratifying, but is of the opinion that at present there is lack of capital in the Dominion to work the mines. He is satisfied that if Englishmen were ready to invest their capital in the Canadian mines the result could not help being profitable in every

* * *

The Oldest Working Grinder.

A representative of Canadian Machinery, while recently going through the works of George Butler & Co., Sheffield, England, noticed an old man at work despite his 83 years of age. The old fellow, James Sadler by name, commenced razor grinding when 13 years of age, and is still hale and hearty enough to spend four or five hours daily at his favorite work, three sons, one being 58 years old, assisting him at his wheel.

When he first entered the cutlery trade Sadler worked for Sir Frederick Thorpe Mappin, and went to Messrs. George Butler & Co. some 30 years ago, working there ever since. As may be guessed, he has ground thousands and thousands of razors in his time. When he gets into a reminiscent mood he has some interesting tales to tell. The great Sheffield flood is very fresh in his memory, and on that disastrous occasion he saw a stable full of dead bodies. The trades outrages, too, are well remembered by this veteran, and he was personally acquainted with most of the men who were punished for the despicable deeds they committed. In his younger days Sadler traveled by the old stage coaches, and he is one of those veterans who can boast of having journeyed in this manner as well as by water and rail. When he was 80 years of age a few of his friends entertained him to supper and presented him with a walking stick.

* * *

Climbing the Ladder.

In keeping with the general spirit of United States firms in recognizing Canadian ability and worth, the Wagner Electric Manufacturing Company has appointed Mr. G. Percy Cole, B.Sc., to the position of assistant chief engineer. Mr. Cole is a Montreal boy and an honor graduate of McGill University. That his success is well merited is the unanimous opinion of his many friends in this country.

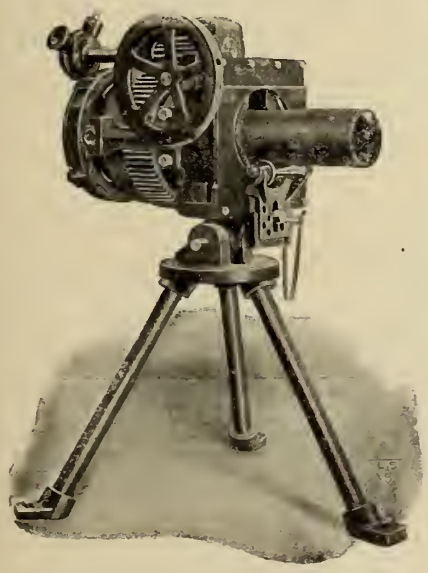
Niagara's Future.

Monsignor Laflamme, the Quebec geologist appointed by the Dominion Government to investigate the geological conditions at Niagara, has recently placed on record his report to the Government. It is more or less a compilation of what has been already known on the subject. He assures Canada that as far as the action from natural causes is concerned this country will be the gainer, the future pointing towards the entire elimination of the American cataract. As a prophecy and a forecast of the future this report is interesting, but what is forecasted will not affect the present generation, nor possibly many succeeding ones.

New York and Brooklyn report 52 per cent. more construction in 1905 than in the corresponding period of 1904. Buffalo, 4 per cent. ; Chicago and Cincinnati, 60 per cent. ; Columbus, 65 per cent. ; Denver, 50 per cent. ; Detroit, 56 per cent. ; Indianapolis, 41 per cent. ; Kansas City, 27 per cent. ; Louisville, 76 per cent. ; Memphis, 29 per cent. ; Milwaukee, 28 per cent. ; Minneapolis, 35 per cent. ; New Orleans, 9 per cent. ; Omaha 69, Philadelphia 19, Pittsburg 49, San Francisco 30, St. Paul 80, St. Louis 88, Tacoma 4, and Washington 77 per cent. These reports are so favorable that they seem exaggerated, but there cannot be much doubt that they are approximately correct.

CONTENTS.

Modern Canadian Mfg. Plants..... 1
Canada Car Co's Plant, Montreal.
An Evidence of Progress..... 5
Allis-Chalmers Steam Turbine..... 7
Engineering News 9
Editorial 10
A Happy New Year.
Union of Capital and Labor.
Fake Investment Propositions.
Long Power Transmission.
Mineral Prospects.
Small Automatic Work.
Rungs in the Ladder of Success.... 12
Designing a Molding Machine..... 13
By T. C. Richardson.
Burning Expensive Parts Together.. 14
By Edwin Krug.
Making Cold Drawn Shafting..... 14
Cost Keeping..... 15
By G. C. Keith.
Book Reviews 16
Reviews of the Month..... 17
Perpetual Motion Machines.
Our Heritage of the Mechanical Arts.
Electric Refrigeration.
The Heroism of Industry.
Time Element in the Repair Shop.
Case Hardening of Steel.
The Nature of Lightning.
Construction and Improvement..... 21
The Growth of Sky-Scrapers.
Cement in Buildings.
Artificial Brick.
A New Method of Worm Wheel Cutting 22
By W. B. McLean, B.Sc.
A Prayer..... 24
By Robert Louis Stephenson.
Power and Transmission..... 25
Opportunity for Gas Engine Builders.
Dailey Rotary Engine.
The Turner Carburettor.
B. C. Men Invent.
A Novel Water Hoist.
The Chicago Hose Coupler.
Blast Furnace Gas.
Improved Propeller Fan.
About Catalogues..... 30
Practical Questions and Answers.... 31
Machinery Development..... 32
200-Ton Hydraulic Press.
An Interesting Story.
Cincinnati Shaper Parts.
Latest Radial Drill.
A Wonderful Digger.
Universal Milling Machinery.
Our Water Power..... 37
Companies Incorporated..... 38
Industrial Progress..... 39
Personal Mention..... 45



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Readers of CANADIAN MACHINERY are invited to use this directory as a ready reference when seeking to buy any machinery or machinists' supplies. In it will be found a list of goods made by leading Canadian firms and by the principa firms in other countries who are devoting especial attention to the Canadian market. It is the intention of the publishers of this paper to issue a desk index for machinery buyers, and all advertisers are invited to send in full list of lines manufactured.

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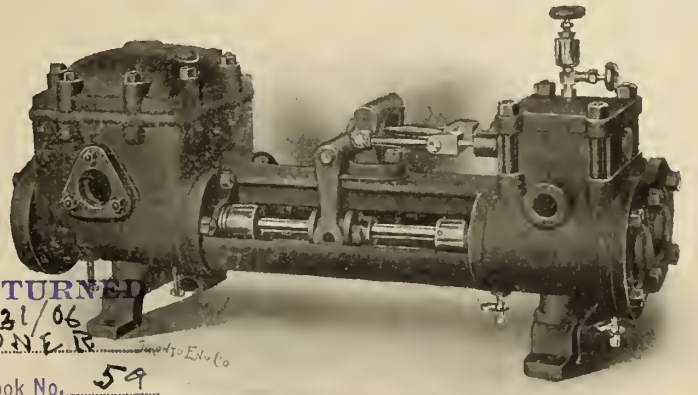

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Sheldon & Sheldon, Galt.
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Brown & Sharpe, Providence, R.I.
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Cincinnati Milling Mach. Co., Cincinnati.
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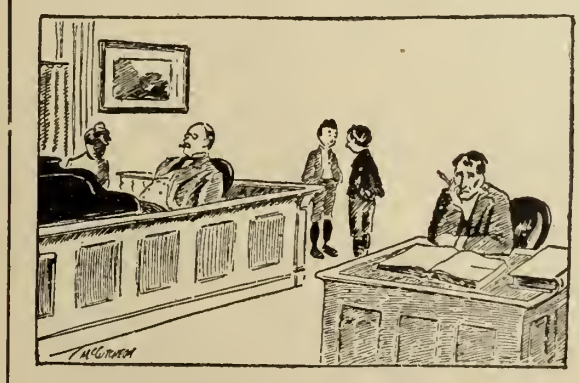
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ALPHABETICAL INDEX.

A

Abbott, Wm. 77
Allis-Chalmers-Bullock Co. ..... Outside back cover
American Tool Works Co 3

B

Barnes, B. F., Co. 75
Banfield, W. H., & Sons 73
Becker-Brainard Milling Machine Co. . 10
Bertram, John & Sons 3
Boynton & Plummer 14
Bickford Drill & Tool Co. 6
Brandeis, Charles 67
Brown & Sharpe Mfg. Co. 76
Budden, Hanbury A. 67
Butterfield & Co 70

C

Canada Foundry Co. 63
Canada Machinery Agency 10
Canadian Press Clipping Bureau. 64
Canada Chemical Mfg. Co. 11
Canadian Co-Operative Co 65
Canadian Fairbanks Co 9, 15, 16
Canadian Rand Drill Co. 12
Canadian Westinghouse Co. 1
Canadian White Co 71
Chapman Ball-Bearing Co. 9
Chicago Pneumatic Tool Co 75
Cincinnati Shaper Co. 4
Clark-Demill Co. 63
Cleveland Automatic Machine Co 7
Crain Rolla L. Co. 65

D

David, R. Sullivan 77
DeCew, J. A 67
Diamond Saw and Stamping Works. ... 69
Dodge Mfg. Co 8
D'Olier Engineering Co. 7
Dominion Belting Co. 72
Dominion Rock Drill Co. 72
Dominion Sewer Pipe Co. 10

E

Eco Magneto Clock Co 72
Electrical Construction Co. 78
Engineering Specialties Co 72
Engineering Times 72
Expanded Metal and Fireproofing Co. 65

F

Fetherstonhaugh & Co. 67
Fetherstonhaugh & Blackmore. 67
Fielding, John S. 67

G

Geometric Tool Co. 74
Globe Machine & Stamping Co. 69
Goldie & McCulloch Co. 1
Greening, B., Wire Co. 4

H

Hamilton Pattern Works 65
Hare, F. E. 77

J

Jardine, A. B., & Co. 74
Jenckes Machine Co. 76
Jessop, Wm., & Sons 77

K

Ker & Goodwin 73
Krug & Crosby 69

L

Lewis, Rice & Son 77
London Machine Tool Co. 5

M

McLean & Sophus 7
Marion & Marion 67
Merrell Mfg. Co. 9
Morrow, John, Machine Screw Co. 74
Morton, B. K., & Co 69

N

National Machinery Co. 72
New Process Twist Drill Co. 73
Nicholson File Co. 71
Nugent, Wm. W., & Co. 72

O

Otis-Fensom Elevator Co. inside back cover
Ottawa Steel Castings Co. 69

P

Packard Electric Co. 78
Parke, Roderick J. 67
Penberthy Injector Co. 72
Petrie, H. W 13
Power and Gas Machine Co. 79
Pratt & Whitney Co .. inside front cover
Pringle, T., & Son 67

R

Ridout & Maybee 64
Rubbra, Alfred. 65

S

Sadler & Haworth 66
Sebastian Lathe Co 14
Sells Commercial 70
Sheldon & Sheldon 4
Smart-Turner Machine Co. 14
Standard Tool Co 75
Standish, W. T. 9
Starrett, L. S., Co. 73
Stevens Co. of Galt. 5
St. Lawrence Supply Co 70
Sturtevant, B. F., Co. 11
Superior Mfg. Co. 77
Spon & Chamberlain 69
Sylvester Mfg. Co. 7

T

Taylor & McKenzie 14
Technical Pub. Co. 79
Toronto and Hamilton Electric Co 76
Toronto Plate Glass Importing Co. 65

U

Underwood, H. B., & Co. 71
Union Drawn Steel Co 77
United Electric Co. ..... Inside back cover

V

Volta Electric Repair Works. 6

W

Waterous Engine Works Co. 12
Wayland Williams & Dadson 6
West Haven Mfg. Co. 74
Wells Pattern & Model Works. 65
Williams & Wilson 2
Wilmarth & Morman 5

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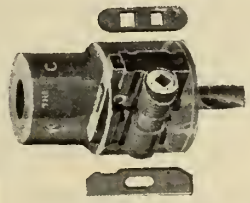

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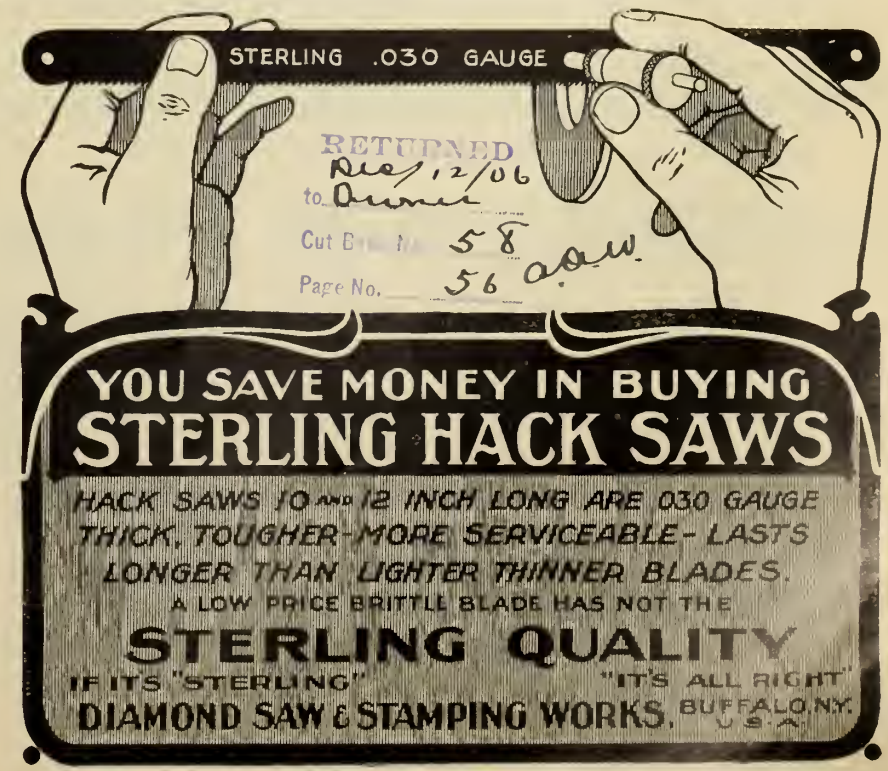
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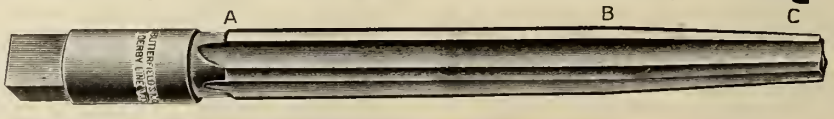

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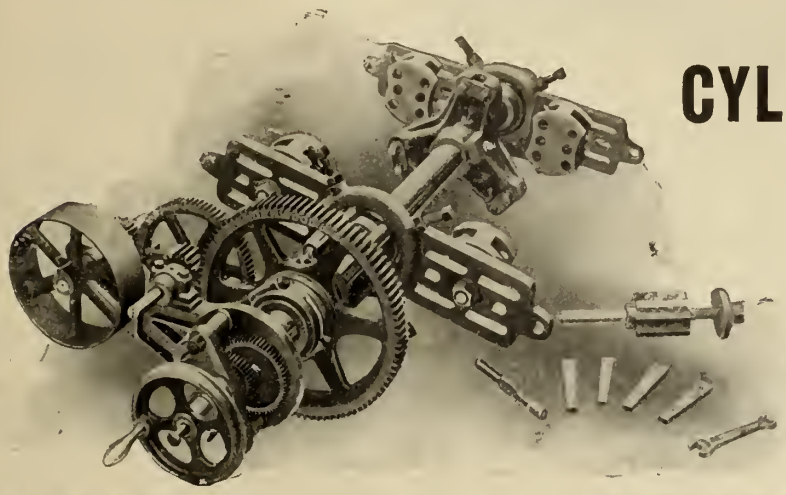

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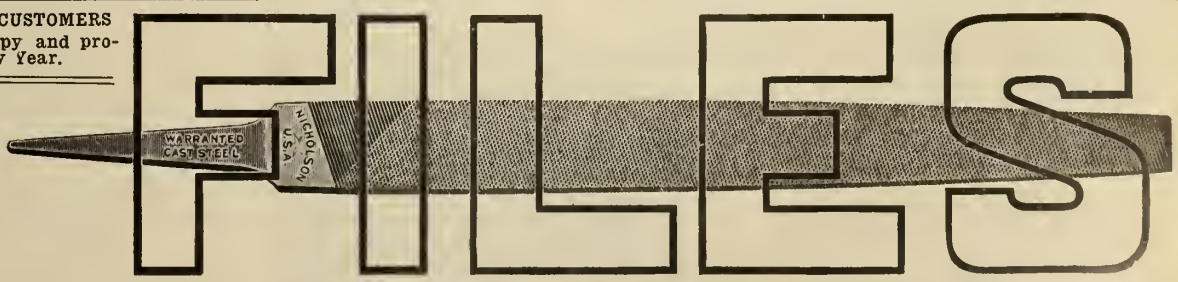

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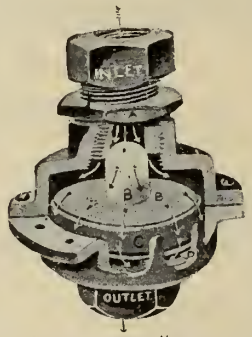

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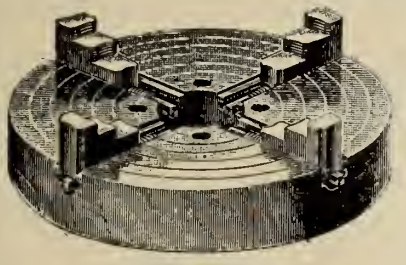

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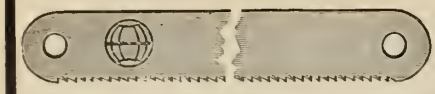

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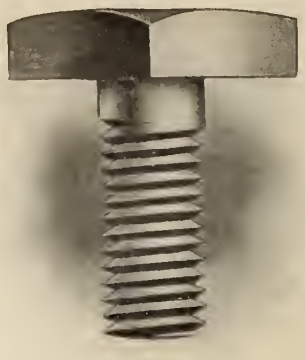

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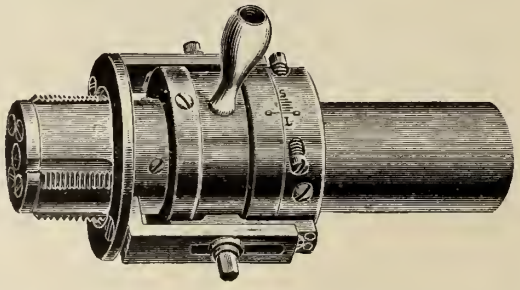

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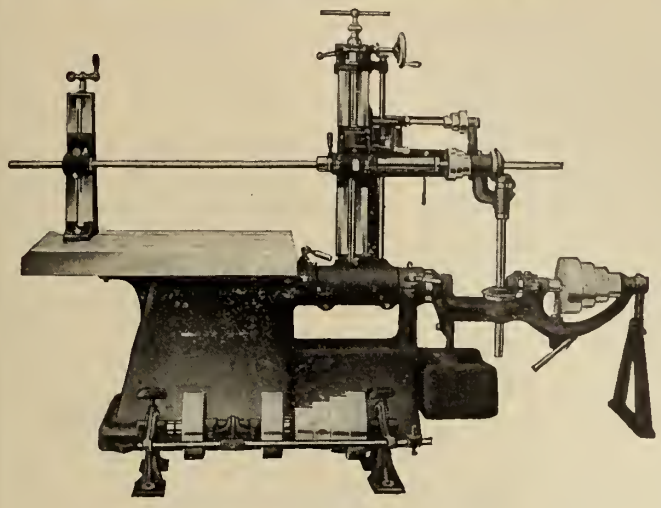

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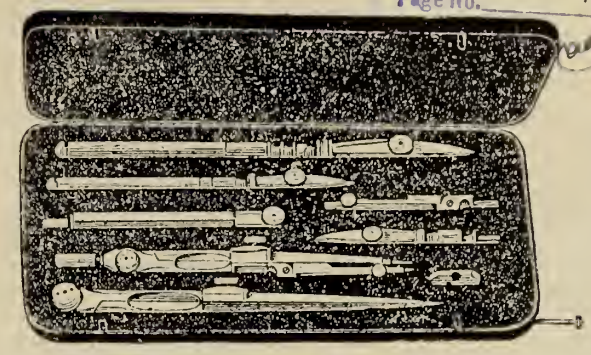

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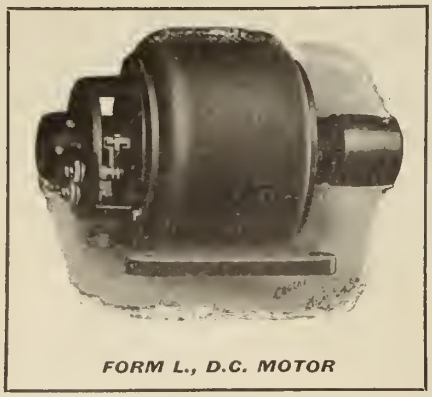

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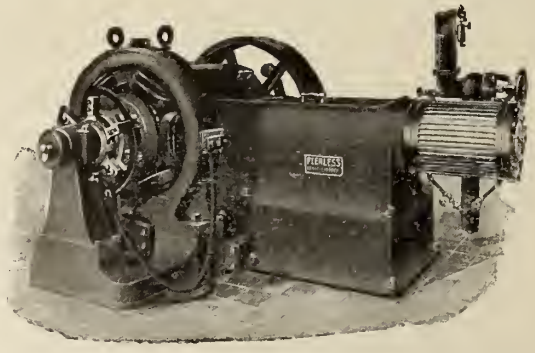

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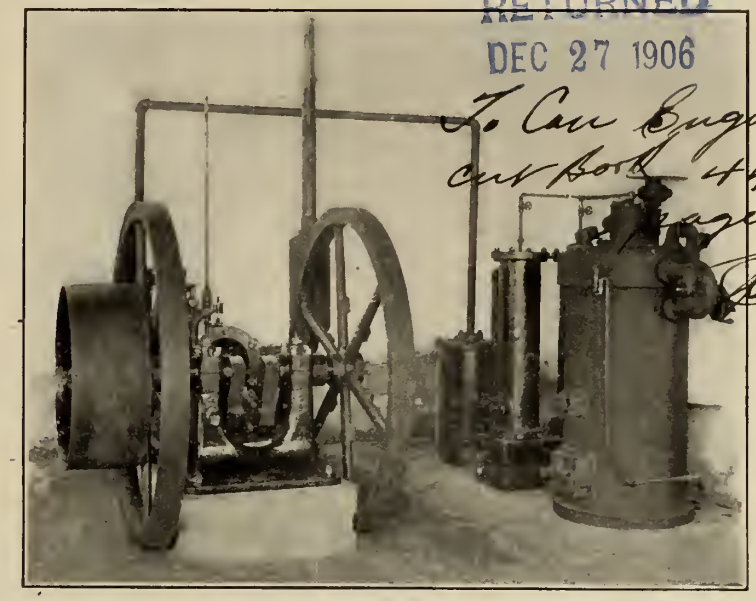

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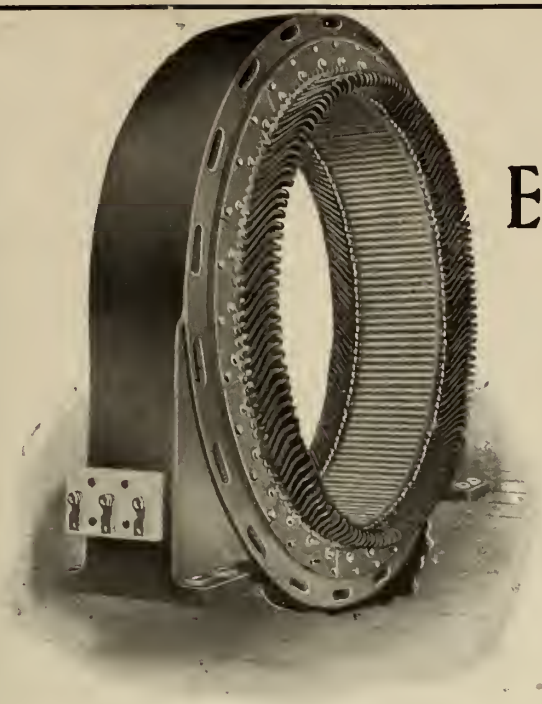

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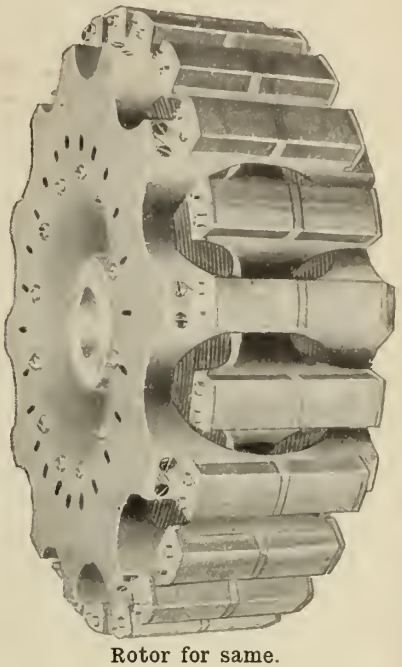

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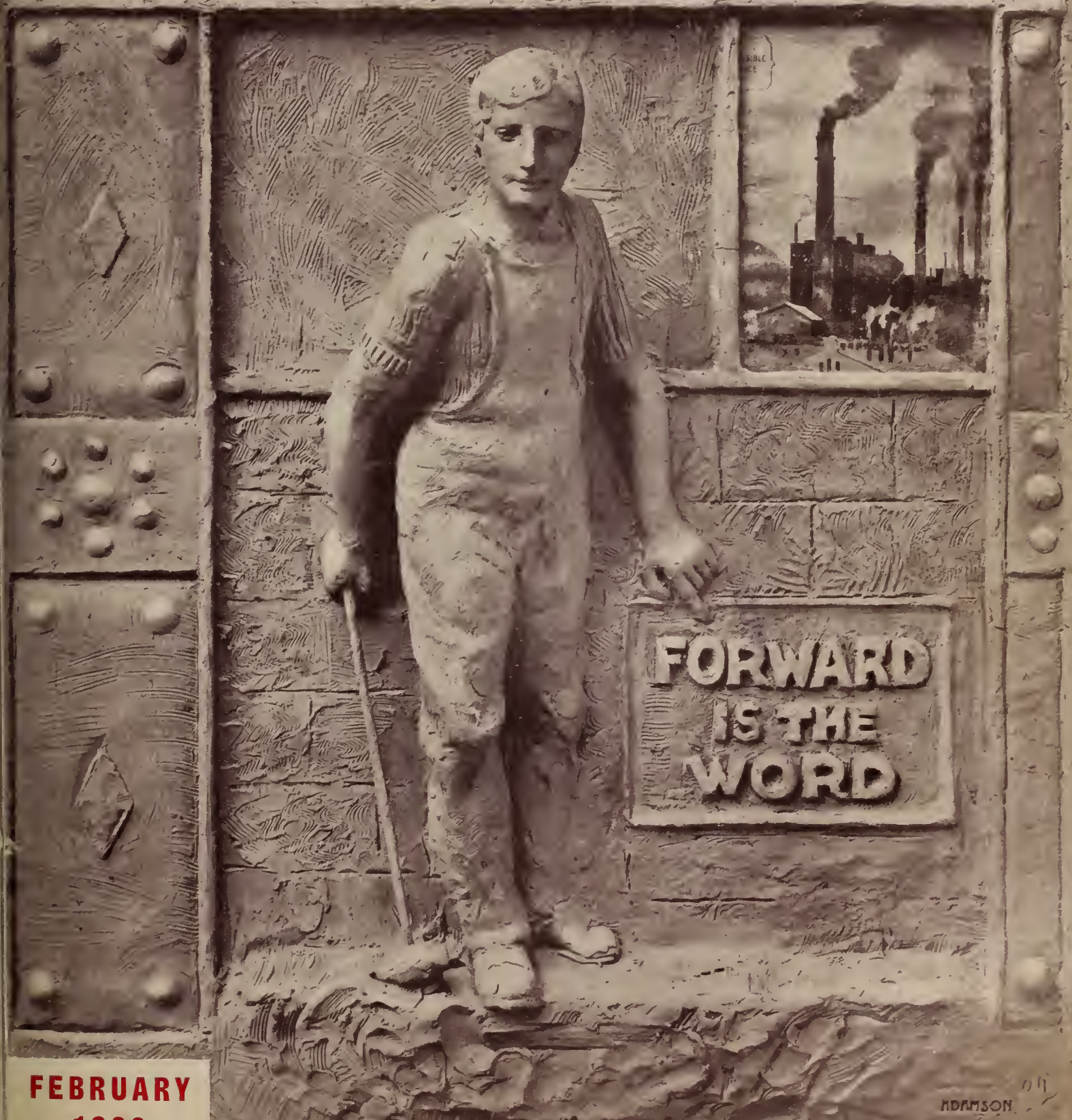

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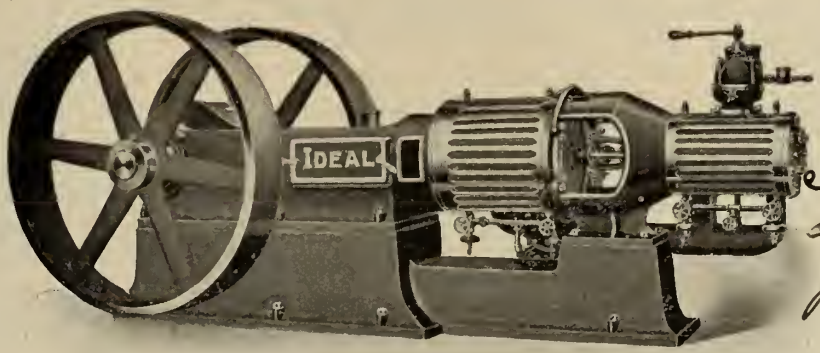

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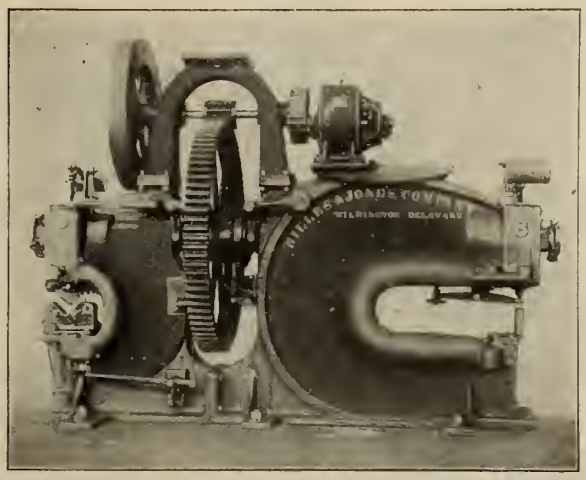

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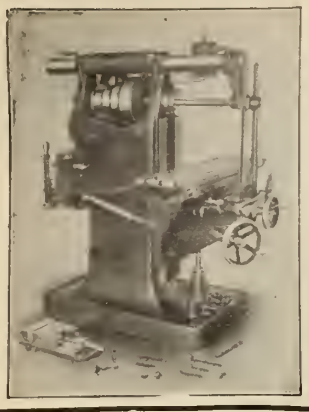

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It is the real merit of our products that has built up the largest milling machine business in the world.
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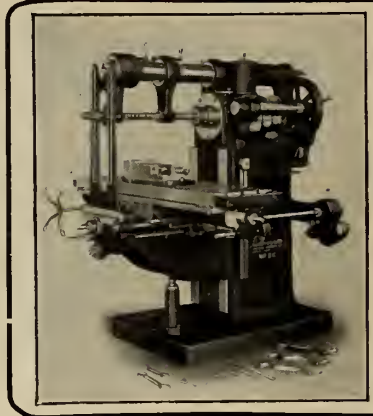

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BERTRAM 48-INCH MOTOR-DRIVEN PLANER

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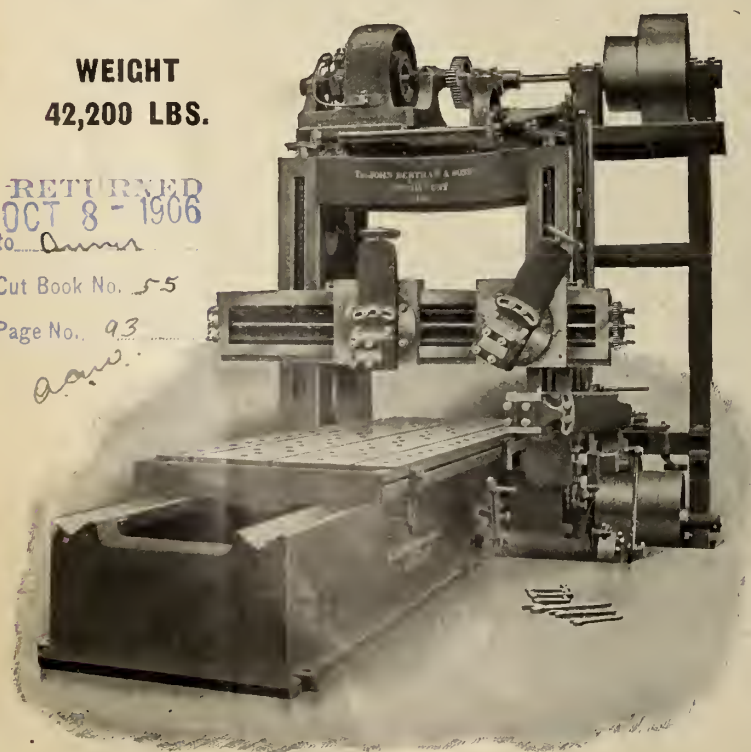
42,200 LBS.



With a solidity afforded by 42,200 lbs. of well-placed metal, with drive gear, rack and pulleys throughout made of steel, this machine is built to withstand the heaviest and the fastest cuts made possible by modern high-speed steel.

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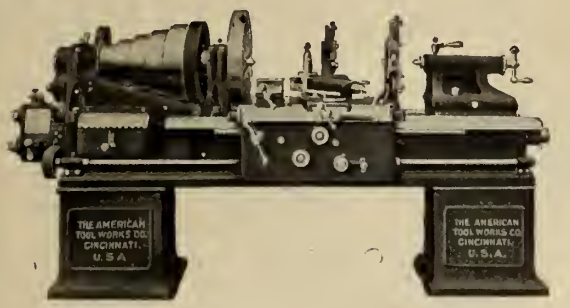

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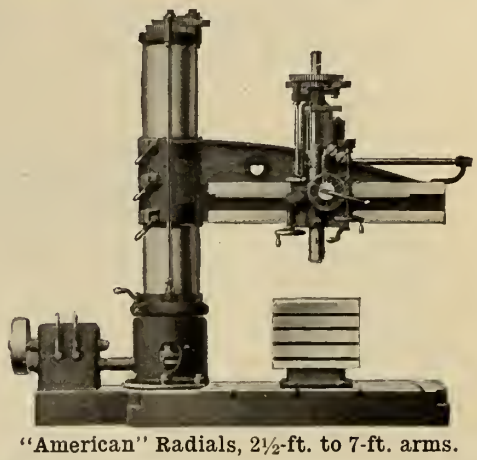

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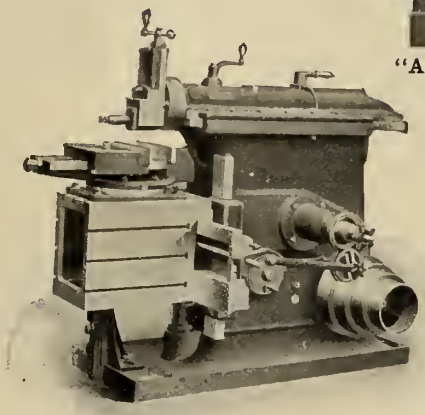

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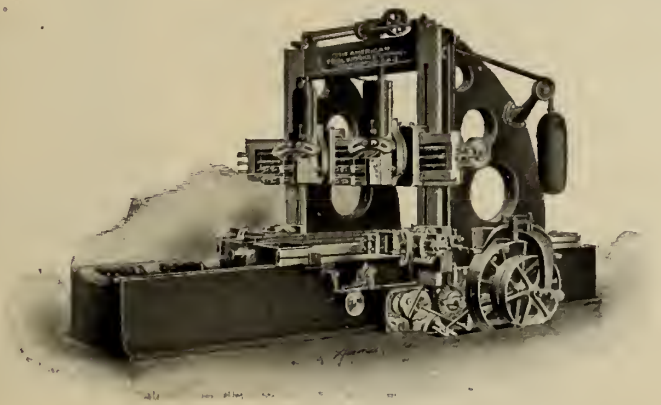

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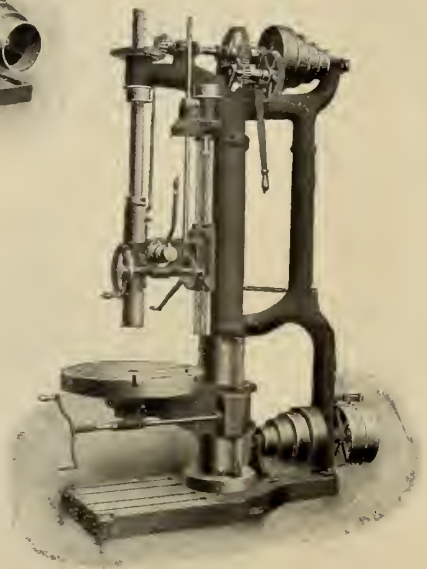

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High Speed Steel
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High Speed Twist Drills

We are prepared to demonstrate the superiority of Edgar Allen High Speed Steel and Twist Drills.

We carry a complete Stock.

WILLIAMS & WILSON

CARBORUNDUM

Carbo. Crystals are the hardest material in the world (except diamonds.)

See our Catalogues.

The Modern Abrasive.

We carry a Complete Stock

All Wheels Are Guaranteed

WILLIAMS & WILSON

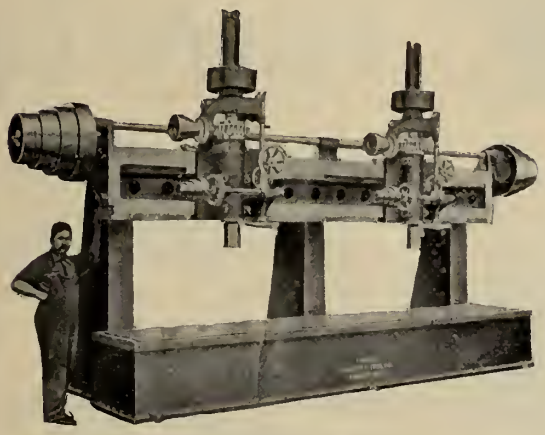
320-326 St. James St., MONTREAL

LONDON MACHINE TOOL CO.

LONDON. - ONT.

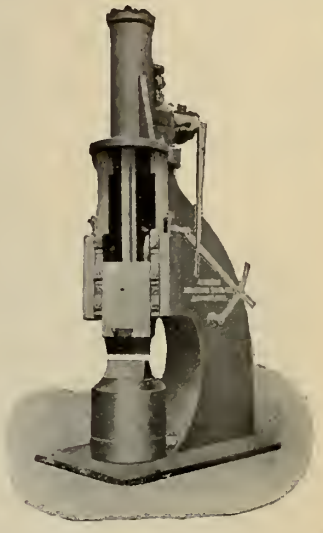
Manufacturers of HIGH-GRADE.... **MACHINE TOOLS**

Can equip our Machines for Motor Drive.

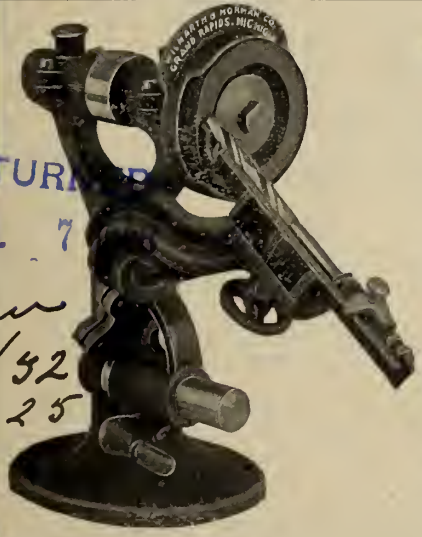


Duplex Rod Boring Machine.

Lathes,
Planers,
Shapers,
Steam Hammers,
Drop Hammers,
Plain Drills,
Radial Drills,
Boring Mills,
Presses.



1,000 lb. Steam Hammer.

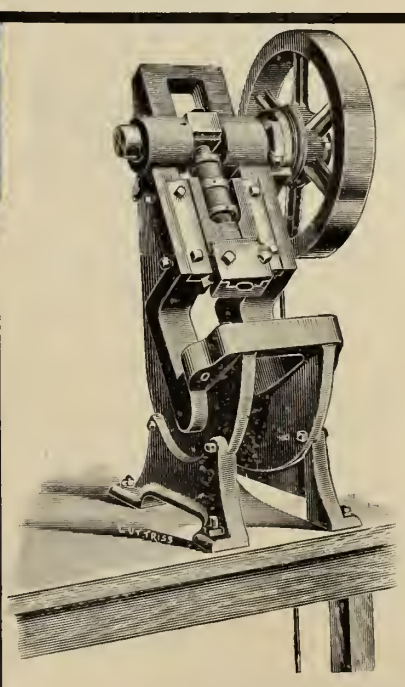


MAYBE YOUR DRILLS ARE MOSTLY SMALL ONES.

In that case we invite your attention to the Bench New Yankee Drill Grinder here shown, for drills from No. 60 (1-25 inch) up to 5-8 inch. It's QUICK, HANDY, ACCUARTE, CONVENIENT, and makes EVERY HOLE YOU DRILL A LITTLE CHEAPER. Then we can also furnish this machine with an emery wheel at the other end of the spindle, for tool grinding.

WE WOULD GLADLY SEND YOU OUR CATALOG.

WILMARTH & MORMAN CO.,
577 Canal Street, - Grand Rapids, Mich.



POWER PRESSES

Canadian Made

ALL SIZES

For Stamping of all kinds

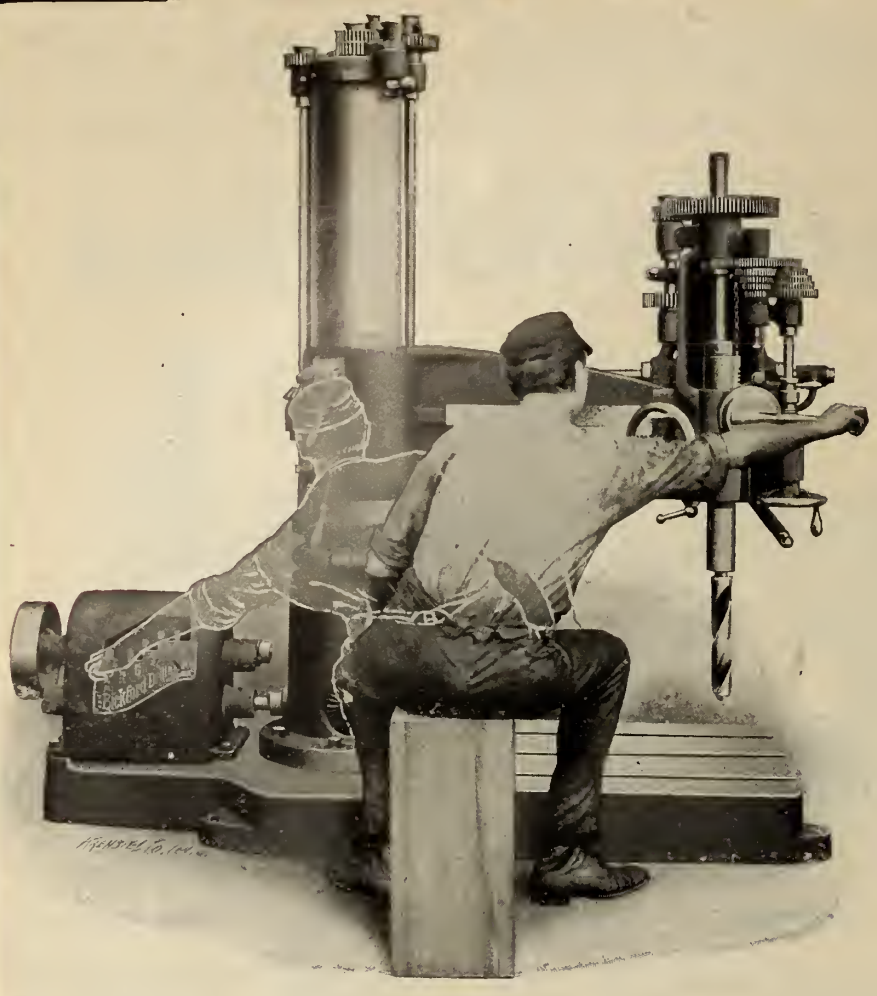
Equipped with instantaneous four-point clutch

Also Tinsmiths', Cornice Makers', Metal Workers' and Canners' Machinery.

Manufactured by

Brown, Boggs & Co., Limited

Special Representative:
W. T. STANDISH, - - Toronto



The Lever You Want Right At Your Finger-Tips

Stop running "round" to the back of your machine for a lever that you use from 1 to 20 times a day.

Everything Within Easy Reach of the Operator

This is what we claim for this new 30″ **BICKFORD RADIAL**—in fact for all our Radials. And we can prove it, too, not by argument or glib assertion, but by actual demonstration. Look at the cut—did you ever see a handier, neater or more stockily built Radial in your life?

And it's just the thing for taking care of the ordinary work as found in the average shop—it was built for that purpose, you know.

Then, again, we want you to put in the little Radial in place of the large Upright you were thinking of buying. It doesn't cost much more, has infinitely greater productive capacity and will out-last and out-drill any Upright ever built.

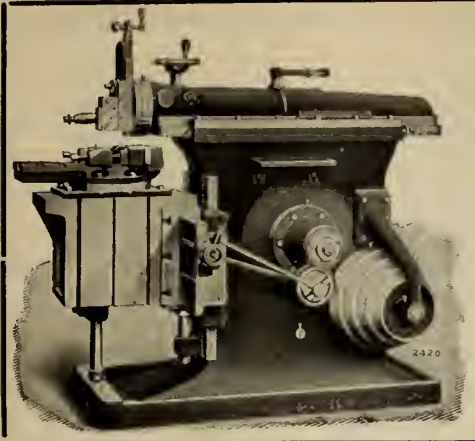
It's made in three lengths of arms, remember, 30″, 36″ and 42″.

Circular 1-A. Shall we send it?

The Bickford Drill and Tool Co.

Cincinnati, Ohio, U.S.A.

FOREIGN AGENTS—Schuchardt & Schutte, Berlin, Vienna, Stockholm, St. Petersburg, New York. Alfred H. Schutte, Cologne, Brussels, Liege, Paris, Milan, Bilbao, New York. Charles Churchill & Co., Ltd., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow.
CANADIAN AGENTS—H. W. Petrie, Toronto; Williams & Wilson, Montreal,



"CINCINNATI" HEAVY DUTY SHAPERS

Are built to stand the excessive strains caused by heavy cuts and big feeds with high-speed steels. All sliding bearings have taper gibs, adjustable endwise by single screws, and the crank block is drop forged. A high-gear ratio, an ample amount of cast-iron properly distributed, and high-class workmanship, combine to place the "CINCINNATI" in the front rank.
Catalog on request.

THE CINCINNATI SHAPER CO.
CINCINNATI, OHIO, U.S.A.
Canadian Agent: - H. W. PETRIE, - Toronto, Ontario

OUR WET TOOL GRINDER
Is Always Ready for Use.

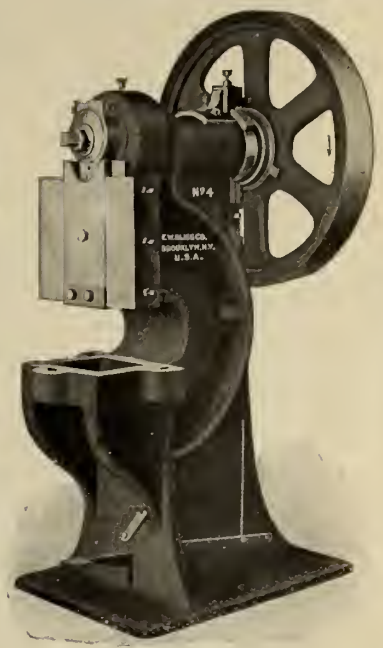
Absolutely nothing to get out of order or in any way give trouble.
Well constructed and easy to operate.
A very practical, efficient and durable wet tool grinder for all kinds of shop tools.
The water is under instant control of the operator.
When thru grinding, the wheel is left free from contact with the water, and remains ready for the next operation.
Complete description in Catalogue N., and the price is attractive.

B. F. BARNES COMPANY, ROCKFORD, ILL.

Ontario Agent:
H. W. PETRIE, Toronto

B. F. BARNES DRILL and LATHE BUILDERS COMPANY GANG DRILLS FOR RAPID WORK ROCKFORD, ILL. U.S.A.

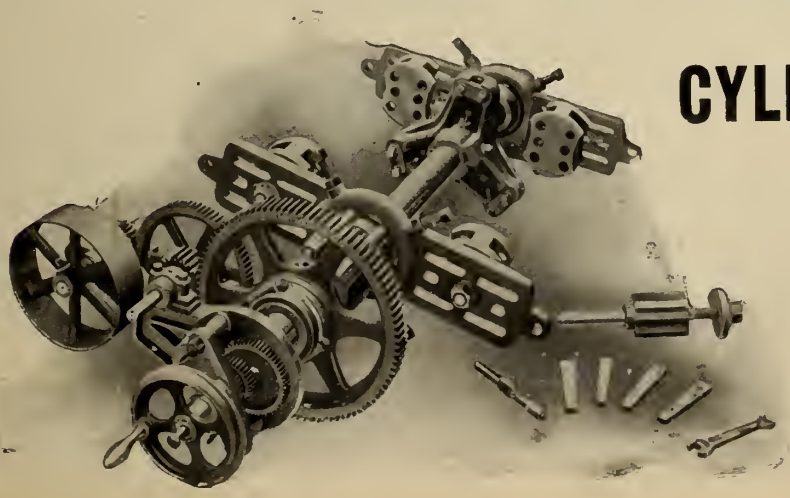
METHOD
has much to do with the success of
"Bliss" Presses and Dies



Our method is to aim at the highest standard of quality, to use the best method of making by using jigs and the most improved machinery, and a method of inspection which prevents imperfect goods from leaving our shop. Large stock. Quality guaranteed. Prices right.

E. W. BLISS CO., 20 Adams Street, Brooklyn, N.Y., U.S.A.

EUROPEAN OFFICE—Clichy pres Paris, France. Distributing Agents for Chicago and vicinity—Stiles-Morse Co., 65 W. Washington St., Chicago, Ill.



PORTABLE
CYLINDER BORING BARS

This Bar Works in Small Places—
Any Place Where the Cylinder Head and Piston Can Be Removed.

A Clean and Accurate Boring

Catalog of Other Railway Repair hop Tools Sent on Request.

H. B. UNDERWOOD & CO.
1025 Hamilton Street, PHILADELPHIA, PA.

Daniel W. Pedrick Morris G. Condon Albert D. Pedric.

Our 20 Years Experience

Designing, Manufacturing and Installing

ROPE DRIVES

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RETURNED

We have installed thousands of horse power

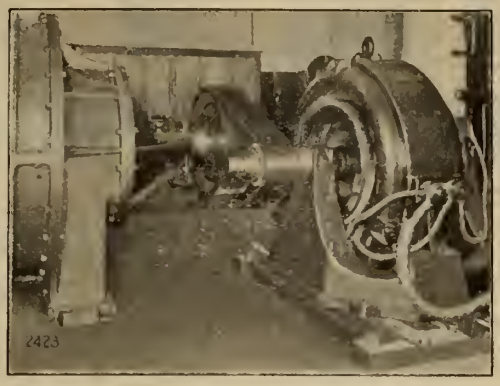
Any power at any angle, any distance, in any direction

Is at your service!

Correspondence solicited

Dodge Manufacturing Co.

Toronto ***Montreal***



Renold Silent Chain driving a blower from 90-H.P. motor at R.H. Macy & Co.'s store, New York City.

Renold Silent Chain

The only bushed chain of its type in existence. ***THE PIN ROTATES,*** so that the wear is distributed evenly at the joints, and the chain does not stretch. It is the most durable as well as the most effective power transmitter yet devised.

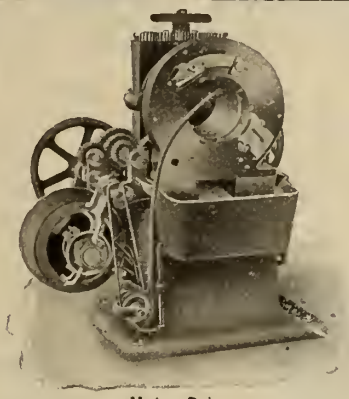
Let us send you Booklet "J" and Bulletins 50, 52 and 58.

The Link-Belt Engineering Co.
PHILADELPHIA

NEW YORK: 49 Dey Street
PITTSBURGH: Park Building
BOSTON: 164 Federal St.

The Link-Belt Machinery Co.
CHICAGO

Merrell Motor and Engine Driven Machines



Motor Drive

The motor is connected up with a double switch, so that the machine can be run either right or left. In addition to the motor, power may be applied by either crank or ratchet to the shaft of the pinion which engages the gear wheel enclosing the dies. These machines have a greater range of work and make quicker changes from size to size of pipe than any other combined machine on the market. The machines are made in four sizes—Nos. 5½, 6½, 9½, 11½.

Beautiful Catalogue sent on receipt of name and address.

THE CANADIAN FAIRBANKS CO., LIMITED

Sole agents for Canada

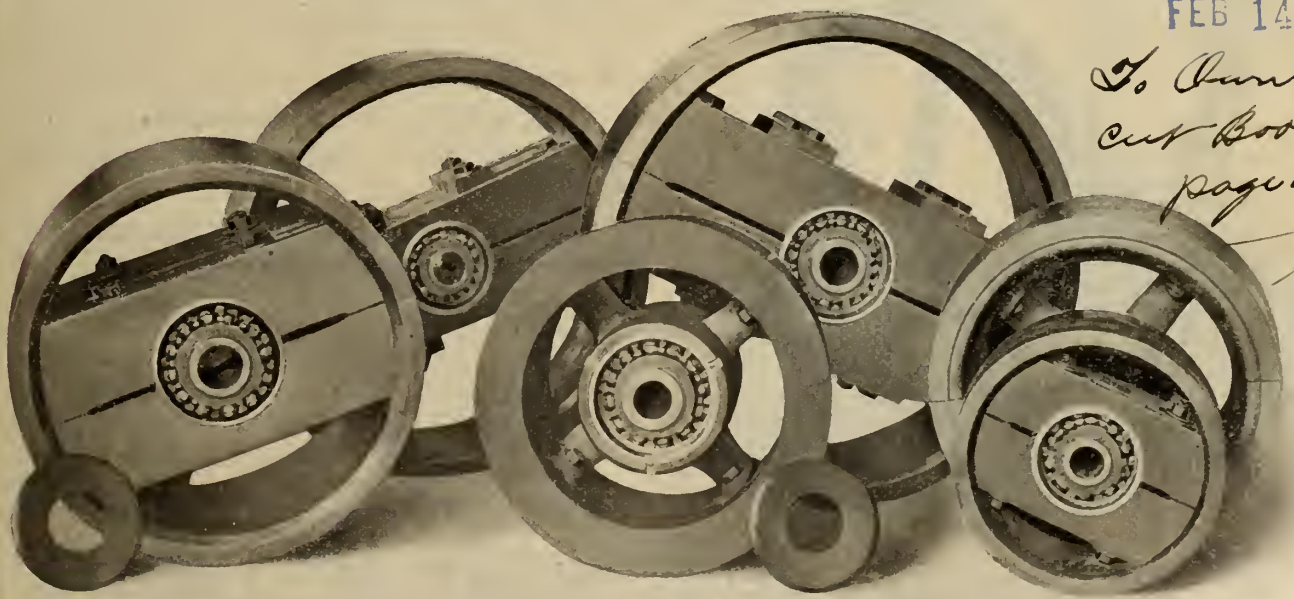
MONTREAL, TORONTO, WINNIPEG, VANCOUVER

HAVING TROUBLE WITH YOUR LOOSE PULLEYS?

Chapman Double Ball Bearing Pulleys will not heat nor cut, will not ruin belting by throwing oil and are guaranteed to give satisfaction.

SPECIFY THEM IN YOUR NEXT ORDER FOR

WOOD-WORKING MACHINERY



Send for catalogues and letters from manufacturers who have them in use.

THE CHAPMAN DOUBLE BALL BEARING CO. OF CANADA, LIMITED

OFFICE—39 SCOTT STREET. FACTORY—39 PEARL STREET, TORONTO.

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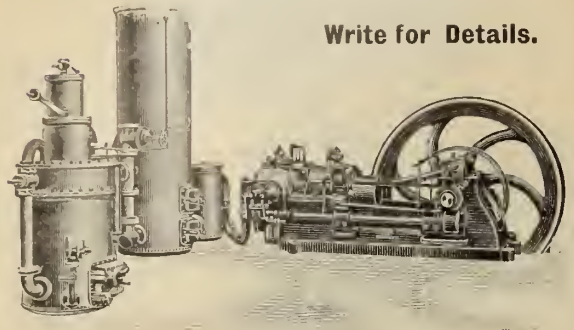
Suction Gas Power Plants

5 to 500 H. P. Units.
Fuel Cost $8.00 per H. P. per Year.

Six of our plants in operation or under erection in Canada.

Write for Details.



Wayland Williams & Dadson

321 St. James St., MONTREAL

High Grade

MACHINE TOOLS

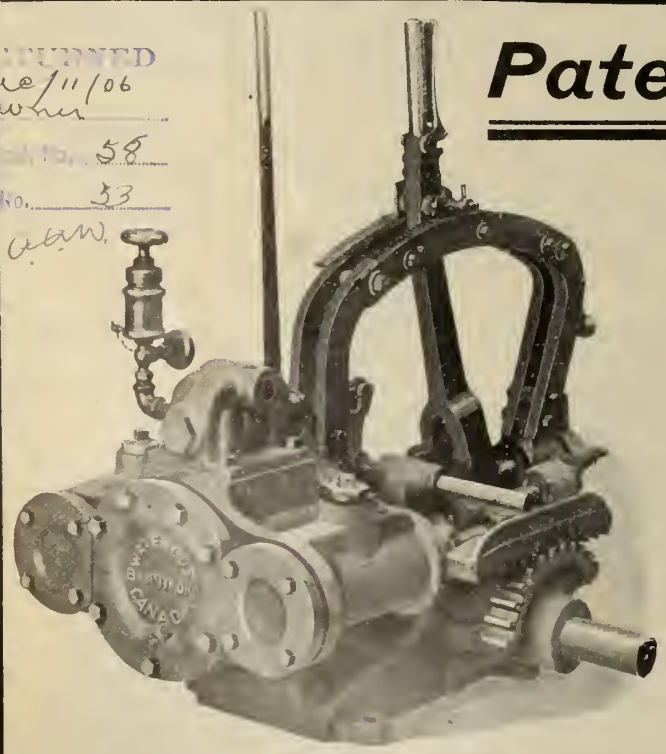
IN STOCK

15″ x 6′ Engine Lathes
15″ x 8′ " "
18″ x 10′ " "
22″ x 12′ " "
27″ x 14′ " "
24″ x 40″ x 10′ Gap Lathes
24″ x 40″ x 20′ " "
24″ x 24″ x 6½′ Iron Planers
24″ x 30″ x 8′ " "
24″ Iron Shaper
32″ Boring Mill
20″ Drilling Machines
24″ " "

Quotations cheerfully submitted

CANADA MACHINERY AGENCY

W. H. NOLAN, Prop. MONTREAL



Patent Steam Setter

Will increase cut from five to ten per cent.

Very Simple
Easily Attached
Very Reliable

The following is what one of our customers has to say about this Steam Setter :

" The Steam Setter which you sold us for this season's cut has satisfied us beyond our highest expectations. After using it for more than six months we are convinced that it has considerably increased our cut of lumber and has more than twice earned what it cost."

Write us for full particulars and price.

THE WATEROUS ENGINE WORKS CO., LIMITED

BRANTFORD, - CANADA

H. W. PETRIE

Offers the following—selected from his present stock of

NEW AND SECOND HAND MACHINERY

WATCH FOR CHANGES IN EACH ISSUE

Wood Planers

30″ Heavy Smoothing Planer.
27″ Cowan Double Surfacer
26″ Mc. G. G. " "
21″ " " "
NEW 24″ x 9″ Surface Planer
24″ Surface Planer, rebuilt.
24″ Pony " "
22″ Surface " "
20″ " " " Gourlay.
NEW 16″ x 9″ Surface Planer.
" 12″ Pony Planer.
" 24″ " Handy " Planer and Matcher.
24″ rebuilt " " "
24″ Double Surfacer and Matcher.
NEW 15″ x 7″ Lightning Planer and Matcher.
13″ Fast-feed Flooring Machine.

Buzz Planers

3 NEW 12″ Pedestal.
1 12″ rebuilt.
1 10″ "
1 6″ "
58″ Stroke Jointer.

Wood Moulders

6″ Four side American.
8″ 3 Side Cowan.
7″ 3 " all rebuilt.
6″ 3 " Cant, Gourlay.
8″ Sash Sticker.
6″ Sash Sticker.

Saw Tables

2 NEW No 1 Clement, Variety
4 " Variety Tables.
Dimension Saw Table.
No. 3 S P Rip Saw, Ballantyne.
Egan Double Cut-off Saw
NEW Champion Cut-off Saw.
Cowan Railway " "
4 Wood Frame Machines.
2 NEW Swing Saws.
2 Rebuilt " "

Band Saws

2 NEW 36″ Pedestal.
36″ Pedestal in good order.
NEW 32″ Pedestal.
" 30″ Bracket.
30″ Bracket, rebuilt.
NEW 26″ Pedestal.

Re-Saws

Rebuilt Band Re-Saw, 54″.
40″ Galt Circular Re-Saw.
36″ " " "
Rogers Vertical "

Other Wood-Working Machines

2 NEW Heavy Shapers.
3 Rebuilt Shapers.
Galt Power Mortiser.
NEW Foot Power Mortiser.
Rebuilt " " "
4 Tenoning Machines.
2 Dowel Machines, 1¼″ and 2¼″.
3 Dovetailing Machines.
36″ Double Drum Egan Sander
3 Box-Nailing Machines.
7 Blind Slat Tenoners.
Borers and Wirers.
NEW Lath Mill, 4 saws.
Waymouth Guage Lathe.
18″ Wood Lathe.
Wood Trimmers, all sizes.
5 Self-acting Shingle Machines.
Swing Shingle Machines.
Shingle Jointers and Packers.

Saw Mill Machinery

2 NEW 3 Block Mills.
3 Rebuilt Mills.
NEW No. 4 Tower Double Edger.
" Tower Trimmer.
No. 1 Gang Edger 3 18″ Saws.
WEN Wood Frame Drag Saw.

Water Wheels

23″ Right Hand Leffel.
25″ " " Farrens.
26″ Left " Leffel
30″ " " Perfection.
Water Wheel Governor.

Horizontal Boilers

66″ x 14′ almost new.
60″ x 17′ 6″ with 54 4″ tubes.
6″ x 13′ 7″ " 84 3″ "
56″ x 14′ 4″ " 64 3″ "
60″ x 12′ " 82 3″ " NEW.
56″ x 12′ " 62 3″ "
48″ x 16′ " 33 4″ "
48″ x 12′ 6″ " 52 3″ "

HORIZONTAL BOILERS—(Continued)

48″ x 13′ 6″ " 42 3″ "
44″ x 13′ 6″ " 43 3″ "
44″ x 14′ 6″ " 44 3″ "
44″ x 11′ 9″ " 42 3″ "
40″ x 12′ " 21 3″ "
33″ x 12′ " 36 3″ "
32″ x 11′ " 22 3″ "

Upright Boilers

48″ x 10′ 6″ with 152 2″ tubes.
36″ x 72″ " 60 2″ "
26″ x 60″ " 37 2″ "
24″ x 48″ " 32 2″ "
24″ x 50″ " 31 2″ "
20″ x 40″ " 41 2″ "
20″ x 36″ " 16 2″ " NEW.
19″ x 44″ " 13 2″ " NEW
19″ x 40″ " 9 2″ " NEW.

Automatic Engines

15″ x 34″ Left hand Wheelock.
13″ x 30″ Right hand Corliss.
11″ x 24″ Left hand Corliss.
10″ x 24″ Right hand Corliss.
12″ x 10″ Westinghouse Junor.
12″ and 20″ x 12″ Erie Ball Tandem compound.
10″ x 15″ NEW No. 8 Jewel.
8″ x 10″ " 5 "
8″ and 13″ x 18″ Tandem compound
6½″ x 8″ Armington & Sims.
5″ x 7″ " "

Other Steam Engines

Complete generating plant, consisting of 2 17″ x 38″ Wheelock Engines; 2 73″ x 14′ Goldie & McCulloch Boilers; 2 8″ x 12″ x 12″ Condensers, Pumps, Heater, etc. Also 2 100 K.W., M.P. —4 Generators, Canadian General Electric Co. make. This plant was last used to run an Electric Railway line of 10 cars.
12″ x 18″ rebuilt horizontal.
11″ x 11″ Leonard centre crank.
10″ x 15″ Erie centre crank.
10″ x 16″ rebuilt horizontal.
12″ x 12″ Laurie, NEW, horizontal.
8¾″ x 9″ horizontal.
8″ x 8″ Laurie, NEW, horizontal.
7″ x 12″ horizontal.
7½″ x 9″ Dutton NEW, horizontal
7″ x 7″ NEW, upright.
6″ x 9″ horizontal.
6″ x 7½″ " centre crank.
6″ x 8″ upright.
6″ x 6″ " NEW.
5″ x 6″ horizontal.
5″ x 7½″ upright, centre crank.
Also several small engines down to ¾ h.p., horizontal and upright.

Marine Engines

12″ x 2½″ x 18″ steeple compound.
8″ and 16″ x 12″ NEW, fore and aft.
7″ and 14″ x 10″ " " " "
7½″ and 14″ x 12″ steeple compound.
5″ x 10″ x 6″ fore and aft with shaft and wheel
3½″ x 7″ x 6″ fore and aft, compound.
14″ x 14″ with shaft and wheel.
9″ x 12″ Doty.
9″ x 12″ NEW, complete.
8″ x 8″ " "
7½″ x 8″ " Dutton.
6″ x 6″ all complete.
5″ x 7½″ " "
Also several smaller ones.

Miscellaneous Engines and Boilers

30 H. P. Horizontal Self-Cont. Boiler.
60 H. P. Fire Box Boiler.
50 H P. " "
25 H. P. " "
16 H P. Waterous Portable Boiler.
9″ x 10 New Portable on wheels.
7″ x 10″ Cornell " "
74″ x 11″ Clyde Boiler.
48″ x 72″ Fitzgibbon Boiler.
48″ x 72″ upright submerged tube Boiler.
4 H P. Acme Engine and Boiler.

Gas or Gasoline Engines

One 50 H. P. New Ohio.
One 21 H. P. New Ohio.
One 15 H P. Pierce.
Two 14 H. P. New Ohio
One 14 H. P. Ohio on wheels.
One 12 H. P. Brantford.
Two 10 H. P. Haggas.
Three 8 H. P. Ohio, NEW.
Two 6 H. P. Ohio.
One 6 H. P. Toronto Junction

GAS OR GASOLINE ENGINES—(Continued)

Two 4 H. P. New Ohio.
One 3½ H. P Triton-Marine.
Two 3 H. P. Upright.
One 2½ H. P. Goldie & McCulloch
Four 1½ H. P. NEW and Second Hand.

Pumps

1 12″ x 7″ x 12″ Northy Duplex
3 8″ x 5″ x 12″ NEW Duplex
5 6″ x 4″ x 7″ " "
6 5½″ x 3½″ x 6″ " "
18 4½″ x 2¾″ x 4″ " "
8 3″ x 2″ x 3″ " "
8″ x 5″ x 12″ Single Acting.
7″ x 4″ x 6″ " "
6½″ x 4½″ x 7″ " "
6″ x 4″ x 6″ " "
5″ x 3½″ x 7″ " "
Several Small " "
NEW Morris Centrifugal, Nos. 2 and 4
NEW Taber Rotary Nos. 0, 1 and 2
3¾″ x 8″ pedestal plunger pump.
3″ x 5″ " " "
2″ x 6″ " " "
Several small plunger pumps.

Steam Appliances

NEW Pulsometers Nos. 4 to 7.
8 Steam Traps, all sizes.
150 h.p., Goldie, McC. Heater.
50 " NEW Laurie Heater
30 " " " "
40 " " Patterson "
30 " National 3″ exhaust
300 x 96″ Heater
16″ x 50″ "
18″ x 30″ "

Engine Lathes

1 NEW 32″ x 20′ London
1 " 32″ x 18′ "
1 30″ x 14″ Heavy bed.
1 NEW 28″ x 18′ London.
1 28″ x 18′ Dundas.
1 NEW 26″ x 16′, also 10′ bed.
5 new 25″, 10′, 12′ and 14′ bed.
8 " 24″ from 10′ to 20 ft.
4 new 21″, 8′, 10′ and 12′ bed.
10 " 18″ " 6′ to 16 ft.
1 24″ x 8′ Dundas.
1 18″ x 6′ in good order.
11 NEW 16″ from 6′ to 10 ft
2 16″ x 6′ rebuilt.
10 NEW 15″ from 6′ to 10 ft.
4 " 14″ 6 and 8 ft.
3 " 13″ 6 " 8 "
1 11″ x 6′ Dundas.
3 NEW 12″ x 6 ft.
1 " 11″ x 60″ Barnes.
1 " 9″ x 57″ "

Cap and other Lathes

28″ x 40″ x 12′ Gap, Dundas.
NEW 26″ x 42″ x 14′ Gap.
2 " 24″ x 40″ x 12′ "
2 " 24″ x 40 x 16′ Gap.
" 30″ x 46″ x 12′ "
" 18″ x 32″ x 12′ "
12″ x 24″ x 60″ Dundas.
22″ x 8′ Chucking Lathe
18″ x 8′ Davis Turrett Lathe.
16″ x 6′ Fox Lathe.
NEW 15″ x 6′ Fox Lathe.
11″ x 48′ Speed Lathe.
NEW 11″ x 72″ Barnes Foot Power
" 11″ x 60″ " " "
2 " 9″ x 45″ " " "
No. 4½ Barnes " "
9′ x 40″ Cincinnati " "

Iron Shapers

2 NEW 24″ Back Geared Imperial.
6 " 20″ " " "
20″ rebuilt, Ohio.
1 NEW 16″ " " Cincinnati.
1 " 16″ Single Geared "
16″ rebuilt, London.
1 10″ second-hand Ohio.
1 " 7″ Rhodes.

Iron Planers

60″ x 60″ x 11′ American, 2 heads
44″ x 44″ x 17′ American.
42″ x 42″ x 20′ Putman.
NEW 36″ x 48″ x 12′ London.
" 36″ x 41½″ x 10′ London.
30″ x 30″ x 8′ American.
30″ x 24″ x 6 1-2′ American.
26″ x 26″ x 7′ American, 2 heads
2 26″ x 26″ x 7′ American.
NEW 26″ x 26″ x 8′ Imperial.

IRON PLANERS—(Continued)

4 " 24″ x 24″ x 6½′ Imperial
5 " 20″ x 20″ x 5′ London.
24″ x 24″ x 36″ American.
23″ x 23″ x 5′ American.
23″ x 20″ x 5½′ American
3 Small Hand Planers.

Drilling Machines

NEW 42″ Baush boring mill, with swivel and Turrett heads.
3 NEW 100′ Plain Radials.
2 " 72″ Universal Radials.
NEW Baush 6 spindle drill with tapping attachment.
1 6 Spindle Multiple.
1 4 " "
2 NEW 31″ Barnes.
1 " 28″ "
1 " 24″ Cincinnati, with tapping attachment.
1 NEW 24″ London.
1 24″ in good shape.
7 NEW 20″ Barnes, B. G
3 " 20″ " Lever Feed
2 " 14″ Sensitive, Pedestal.
2 " 14″ " Bench.
2 11″ Plain, Upright.
1 NEW 12″ Barnes Friction.
2 " 14″ Friction.
1 " Fox High Speed Drill
6 Sensitive Bench Drills, NEW.
2 Post or Wall Drills.
8 Blacksmiths' Hand Drills.
6 " " and Power Drills.

Presses and Hammers

5 No. 2½ Power Presses, NEW.
4 " 20 " " "
1 " 18 " " "
3 " 19 " " "
1 " 16 " " "
No. 2 Cady Press.
NEW No. 1, Challenge Soap Press.
PowerDraw Press.
NEWErie 400 lb. Steam Hammer.
" 150 lb. Drop Hammer.
2 " 150 lb Law Power Hammers.
60 lb. Palmer Spring "
NEW 50 lb. Foot Power "
4½″ x 10″ Steam Hammer.
Several smaller ones.

Punches and Shears

1 NEW 20″ throat, London.
5 " 15″ " "
14″ throat, Bertram make.
NEW No. 5, Bremer, Single.
" " 4, " Double.
" " 2, " Single.
" " 1, " "
" " 1, " Double
Large Power Alligator Shear.

Other Machine Tools

NEW No. 1, Cincinnati Plain Miller
30″ x 6″ x 16″, Stevens Un. "
6 NEW Power Hack Saws.
5 Iron Frame Key eaters.
NEW 2″ Cutting-off Machine.
" Centreing Machine.
Large Hand Screw Press.
2″ Bolt Cutter and Threader.
NEW 1½″ National Bolt Cutter.
" 1″ Acme " "
" 2″ " " "
" 2″ bolt cutter with adjustable dies.
4″, Curtis Pipe Machine.
Several Bench and Pedestal Emery Grinders —all sizes.
2 NEW 2½ Ton Portable Cranes
Crab Winches—all sizes.

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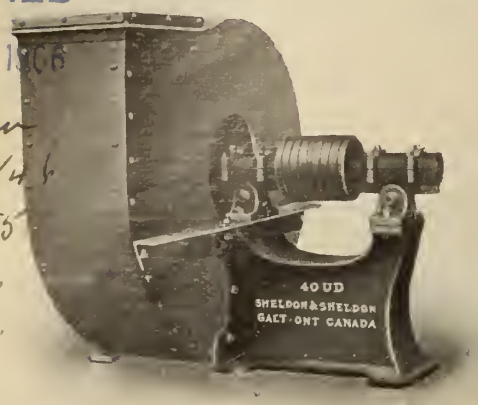

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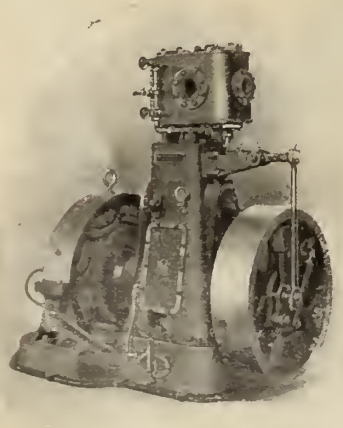

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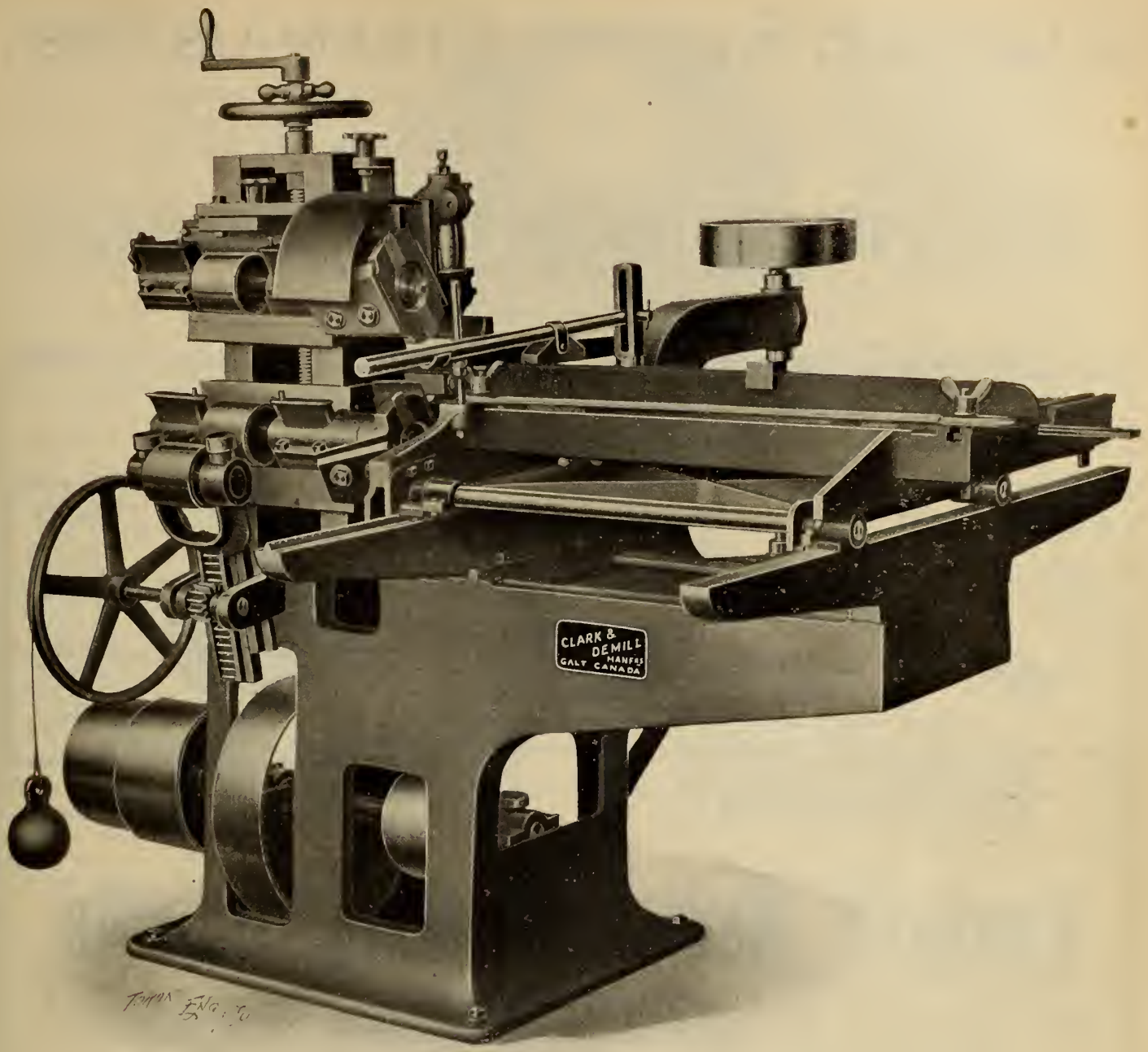

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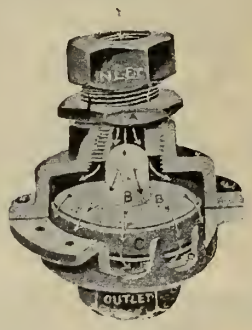

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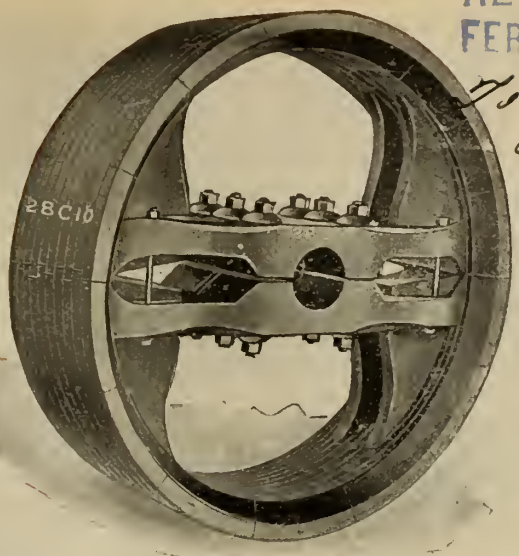

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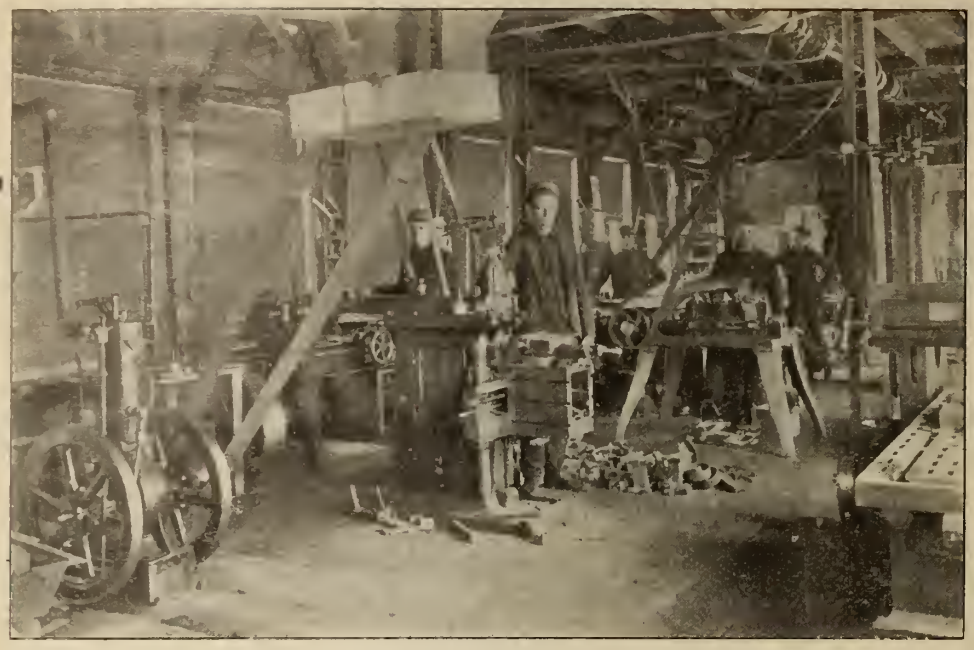

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THE CANADIAN FAIRBANKS CO. LTD.

MONTREAL TORONTO WINNIPEG VANCOUVER

Modern Canadian Manufacturing Plants.

ARTICLE XII.—Large Wood-Working Establishment of James Davidson, Ottawa.

A Story of Progress.

IN 1874 a modest wood-working shop was started at Mount Sherwood, then a suburb of Ottawa. The men interested were Mr. R. Thackray and his stepson, Jas. Davidson, and his brother, R. J. Davidson. These comprised the firm and included the entire staff of workmen. The output consisted of doors only, and of these about five a day were turned out, all work being done by hand.

Fig. 1—Davidson & Thackeray Plant—Main Corridor Looking South.

The first machine installed was a hand-power rip saw. It was a home-made affair with a balance wheel of wood weighted by sash weights. The motive power was supplied by Mr. Davidson and his brother, while Mr. Thackray was the machine operator. Soon, however, this method was found too slow for the burning ambition of these men, and a 10-horse-power engine was brought into requisition. With them it was the growing time. As the output increased more machinery was added and the prime mover increased in size until one of 75-horse-power was reached. All this time more and more men were being added to the company's list of employes.

Removing to Ottawa.

Mount Sherwood being somewhat out of the way it was decided to move the plant to Sparks street, city of Ottawa. Here an unfortunate train of circumstances followed the efforts of this firm. Within fifteen years three plants were entirely destroyed by fire, resulting in complete loss each time. These fires represented a total loss of $250,000, over and above all insurance, yet the firm bore up each time underneath their loss and paid one hundred cents on the dollar.

To-day everything about the firm and the business is done on a large scale. The factory that at present stands as a monument of enterprise and genius of Mr. Jas. Davidson would be a credit to any city. From the manufacture of five doors a day, and that the only line made, the present capacity is a door a minute, and this only one of many lines. It might be mentioned in passing that besides his active business life, Mr. Davidson finds time to take part in the municipal affairs at Ottawa. He is an ex-mayor and at the election held recently he was returned to the office of alderman with the largest vote ever polled in that city.

The firm owns 150 square miles of timber limit on the Coulonge River. Their mill is operated at the junction of the Coulonge and Ottawa Rivers, an ideal situation. The Pontiac & Pacific Junction Railway runs alongside the limit, where the station of Davidson is situated. Here a village has sprung up, three miles from the village of Coulonge and 80 miles from Ottawa. The mill and woods operations are under the supervision of R. J. Davidson.

The Present Plant.

When early in June, 1904, one of the most disastrous fires that ever occurred in a wood-working establishment laid the magnificent Sparks street factory of Davidson & Thackray in ruins, it was agreed by the old firm that not only

Fig. 2—Davidson & Thackeray Plant—Main Building, Part of Door Department.

were more extensive quarters and enlarged facilities necessary to the successful handling of its extensive home and foreign trade in sash, doors, blinds, mouldings, and other stock items, but that a thoroughly modern mill was needed to facilitate the execution of orders for interior finish, odd wood-work of all kinds, and especially the manufacture of their noted North Star refrigerators and toboggans, which lately have developed into a large department in themselves. The plant which this firm proposed to erect, it was decided, must be thoroughly modern and complete and up-to-date, and much time and thought were given to plans for its construction both by the firm themselves and also by the competent foremen in charge of the different departments. Quietly and unostentatiously those plans have been advanced from stage to stage until to-day the factory of James Davidson in its movement and operation is acknowledged to be not only the most up-to-date sash and door plant in Canada, but it is generally admitted that it is one of the best on the American continent. Four acres of ground are occupied by the factory and warehouse buildings, including lumber and stock sheds, and the location is the best that could have been found in Ottawa, fronting as it does on the Richmond road, which is the main artery leading into the city from the county of Carleton. It also faces the tracks and terminals of the Canadian Pacific and Grand Trunk Railways, giving ample opportunities for unloading cars. The mill, dry-houses and engine and boiler-houses are constructed of brick and are as nearly fireproof as it is possible to make them. The mill proper is 300x200 with an "L" 75x200 feet. The dry-houses are 75x100. They are run by the Sturtevant fan system, the fans being run by a Westinghouse motor of 20-horse-power, and the electric current is supplied by the Ottawa Electric Co. The power-house is brick, 40x60 feet. One timber shed is 22x400 and the moulding shed is a double shed, 80x200.

Fig. 3 –Davidson & Thackeray Plant - Planing Mill Looking East, Stickers in Foreground.

The stable is 24x70 and has accommodation for twenty horses. The firm have private sidings on the Canadian Pacific and Grand Trunk Railways. From these sidings wagons are loaded with material incidental to the sash and door business and loaded directly into the dry kiln, where it is allowed to season and thoroughly dry. This dry kiln, which like the mill and office receives its heat from steam supplied by the boilers, is one of the largest in Canada, having a capacity of 100,000 feet. From this kiln, the doors of which lead immediately into the factory, the lumber passes to the planers and leaves them surfaced smoothly. From these machines it progresses rapidly to others, all so set and arranged that the material is handled without loss of time and without waste of motion. Passing from the planers it is transferred to some of the several rip or re-saws, or automatic tables where cut-off saws divide it into desired lengths, and it goes to other of the numerous machines which fill the main floor of the building. Much of the finished product is manufactured almost entirely by these machines, tended by skilled machine hands. Other work may, however, be so elaborate and delicate in its nature that it must be executed largely by hand, and for this work a large number of skilled bench men are required.

Blower System.

An important feature of the mill equipment is the blower system, which has been installed at a cost of about $5,000. This system, consisting of numerous pipes so located that the dust, chips, shavings, and in fact all waste from lumber in course of manufacture is drawn into them directly from each machine, and by suction drawn into two great main pipes leading to a reservoir known as the Cyclone, from which the waste is automatically fed into the furnaces, thus serving the double purpose of cleaning the mill from refuse and adding to the reduction of fuel account. As noted above, steam heat is supplied throughout all buildings and offices and the employes of the company are assured of comfortable working quarters. The heating and blower system are the manufacture of B. F. Sturtevant Co., Boston, and have been found by the firm to give splendid satisfaction. The apparatus consists of a standard Sturtevant 150-inch fan of the three-quarter housing type, driven by horizontal cen-

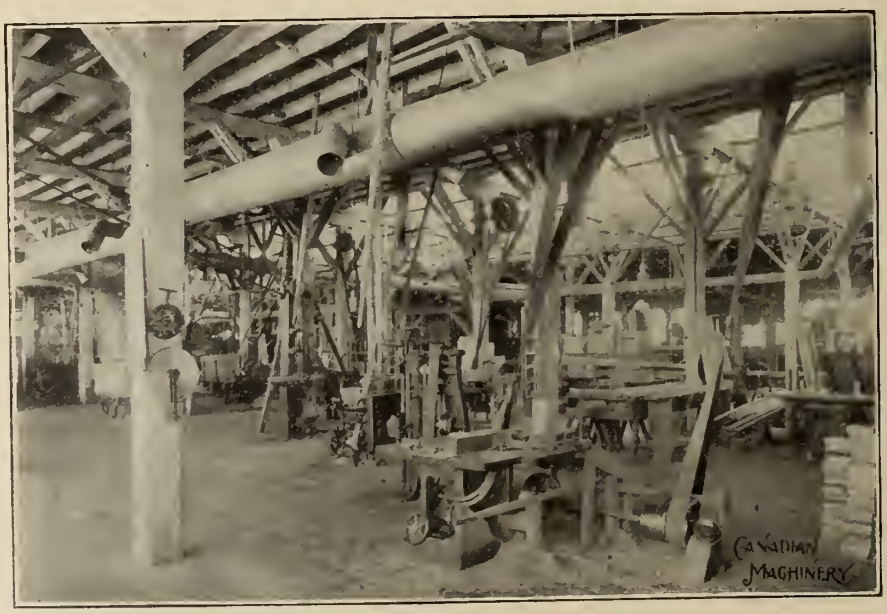

Fig. 4 –Davidson & Thackeray Plant—View in Main Building Looking South-West.

tre crank engine having 7-inch cylinder and arranged to draw the air through a heater containing 12 standard Sturtevant 4-row sections. The air is distributed first through an underground tunnel and thence discharged into an overhead system of galvanized iron piping, carried in each wing of the building. The most important feature of this system lies in the fact that all of the heating surface is massed in a single casing placed entirely outside the building, and a forced circulation of warm air is secured through an extended system of overhead piping with its downward discharging pipes. The building being but one storey, and having so much glass, is naturally hard to heat, but the Sturtevant system has been found to be in this case all that could be desired. In the "L" on the main floor are located the heating and glue rooms, these being equipped with more than the ordinary amount of steam-heated pipes, warmth being a requisite for successful glue work, of which much is done in the production of fine veneered material. Great care is used in this as in every other department of the mill and the output is such as to sustain the high reputation established by the firm. All the machinery has been installed under the supervision of the mill superintendent, Mr. Leander Henderson, one of the most competent men in this line of business in the Dominion. The machinery is the best and latest type, and so conveniently is it arranged that sash and door manufacturers from other Canadian and American cities who have visited the plant have unanimously pronounced it one of the most systematic and up-to-date wood-working plants on the American continent. Electricity is used to light the various buildings, lumber sheds, etc. It requires upwards of four hundred lights, same being supplied by the new Ottawa city municipal plant, lately acquired from the Consumers' Co.

The Power.

The power-house, from which comes the force putting life into the 1,200 feet of line shafting, is a very important part of the plant as a whole, and one which demands a certain amount of attention. The engine installed is one of the Wheelock type, manufactured by Messrs. Goldie, McCulloch Co., of Galt, and is capable of working up to 350-horse-power. Five large boilers, 6x16, are a further portion of the equipment and the power plant is so arranged that if necessary in forty-eight hours by a duplication of engine power, 600 to 700 horse-power can be assured. The boilers mentioned were manufactured by W. J. Campbell, Ottawa, with the patent Dutch oven for burning light fuel, such as shavings, sawdust, etc. The entire fuel used is refuse from the mill. One man only is required for firing the oven, whereas with the same equipment using coal three men would be needed. Part of the power-house consists of a shaving vault 60 feet high and 40x30 feet. On top of the power-house is a separator 8 feet in diameter by 16 feet high, and another on the main mill 12 feet in diameter. These separate the sawdust from the shavings. The sawdust goes into bins directly over the boiler.

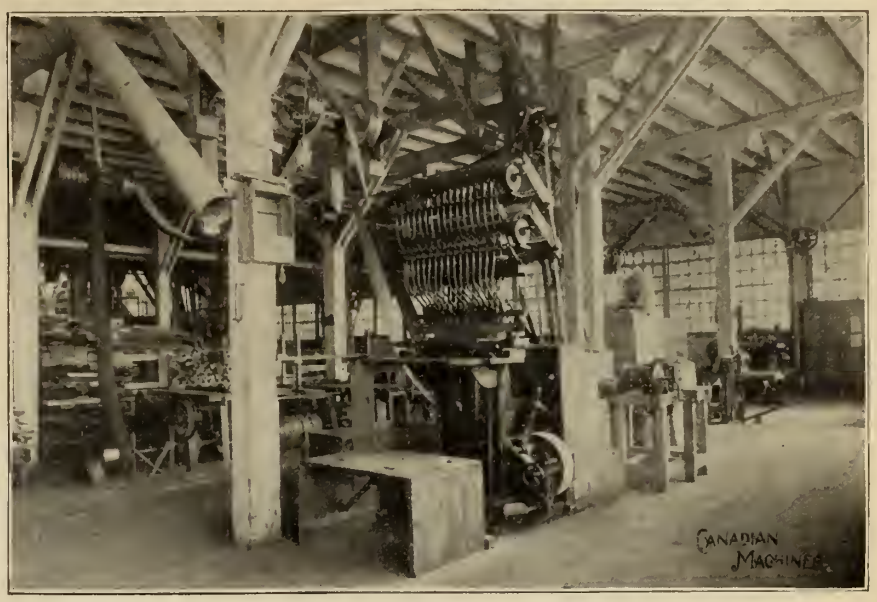

Fig. 6.—Davidson & Thackeray Plant—A Corner of the Box Factory, Nailing Machine in Foreground.

Fig. 5—Davidson & Thackeray Plant—View in Planing Mill, Showing Matchers.

Process of Manufacture.

As doors were the only articles manufactured by this firm in its early history it would probably be of considerable interest to follow the lumber that goes into the make-up of a door. From the drays it is loaded on to large trucks in the kiln. After remaining in the kiln for a sufficient time it passes through a dry shed to the main building and down one aisle to the door department without having been handled again. The lumber, which has already been culled, is planed by a large double-surfacer made by the Berlin Machine Works, Beloit, Wis., of special make for dressing up door stock. From the door planer the lumber passes through rip saws, after which it goes to self-operating cut-off saws made by E. B. Hayes, Oshkosh, Wis. All the material is handled from trucks to machine to trucks, thus insuring a minimum of handling. The equipment for manufacturing doors consists of two complete sets, one for dowel door machinery and the other for all other classes. These machines are all so placed that the material passes from one to the other in natural sequence, thus when the lumber

is finished it is handy to the clamping machine.

From the cutting-off saws some parts go to a double-end tennoner made by the E. B. Hayes Company. The stiles go

Fig. 7.—Davidson & Thackeray Plant—Boiler House Showing Feeders from Sawdust Reservoir.

to the stile borer, where they are bored, and the rails to the rail borer. The latter then go to the automatic glueing and dowel driver, where the dowel pins are inserted automatically and glued. This operation leaves them ready for the door power clamp made by H. C. Doman & Co., Oshkosh, Wis. After clamping the doors are all handled through a 72-inch three-drum door sander, made by the Berlin Machine Works, Beloit, Wis. As the process thus described refers to dowel doors, this is the last operation.

The better class of doors go through as odds, a single-end tennoner, door stickers, chisel mortiser, chain saw mortiser, relisher and door clamp.

These, with the exception of some lighter saws, include the equipment of the door department.

Sash Department.

Material for the sashes is cut out next the door department and goes through the same process of planing, ripping and cutting as the former material. Included in the equipment of this are single end tennoner, chain saw mortiser, sticker, relisher and boring machine, where the different operations are performed by skilled workmen.

Window and Door Frame Department.

Machinery here includes cut-off saws, rip saws, window pocket machine, grooovers, beaders, and a large double-headed machine for checking the head and sill of door frame at one operation. Besides these are a drum and disc sander, combination iron saw tables for mitreing, bevelling, etc., and two buzz planers or jointers and a 30-inch double surfacer.

With this machinery is included a large number of carpenters' benches for the manufacture of office fittings, counters and shop fittings, both in hard and soft wood. The woods used here are white pine, white wood, ash, and white and red quarter-cut oak.

Planing Mill.

This is one of the most important departments in the plant. The equipment consists of two large matchers and planers made by McGregor-Gourlay Co., Galt, Ont., and one special hard wood flooring machine made by Hoyt & Brother, Aurora, Ill. Connected with this machine is a self-operating cross-cut saw and an end-matcher made by Goldie & McCulloch, Galt, Ont. The principal material going through the first mentioned machine is pine and spruce. The pine is run into flooring and sheathing, V-jointed and beaded, as well as clapboarding. The spruce is for flooring. Birch and maple and oak are also made into flooring here. At the present time seventy lineal feet a minute of hard wood flooring is run through.

In this department are also a large re-saw made by the W. B. Mershon Co., Saginaw, Mich., and an S. A. Wood double surfacer, as well as one made by McGregor-Gourlay Galt, Ont. One of the latter firm's make of gang ripping saws was also noticed, as well as another manufactured by Hoyt & Brother, Aurora, Ill. Four stickers are included in the machinery of this department and one dowel pin machine for the doors. Two of these machines were manufactured by the Berlin Machine Works and two by McGregor-Gourlay, while the dowel pin machine is the product of the E. B. Hayes works. In addition to these, there are two power feed rip saws for ripping the moulding stock for the stickers mentioned above.

All the moulding stock comes from the kiln uncut to these two power feed saws. This does away with any additional handling whatever, as the operators take the lumber from the cars as they are wheeled out of the kiln, the same as in the door department, thus saving a large amount of work every day that would otherwise be necessitated if such a system were not adopted. All lumber for this department is sorted under cover or in the mill proper. All lumber coming up for the kilns is loaded directly off the sleighs or wagons on to the cars in the dry kiln, and after drying these cars are taken on tracks into the mill and to the particular department for which the lumber is intended.

Box Factory.

A new building 100x100 feet has just been erected to take care of this part of the business, but at present manufacture is carried on in the wing of the main building, as shown in the illustration. Machinery in this department is all of a special nature, the most noticeable of which is a box nailer. It is a combined cleater and nailer, manufactured by the Doig Machine Manufacturing Co., and will drive sixteen 3-inch nails at one operation. Another important machine in this department is the double color box-board printer, manufactured by the Morgan Machine Co., Rochester, N.Y. It prints two colors at one operation and can print at the rate of 150 impressions per minute. Other machinery here includes cross-cut saws, rip saws, box-sizing machines, mitre saws, cleat cutter and champfering machine, as well as several tying machines manufactured by this firm and upon which they control patents.

Fig. 8 Davidson & Thackeray Plant—A Lumber Shed.

Grinding and Sharpening.

This is always an important department in any large wood-working establishment. The grinding and sharpening equipment here is well in keeping with

the modern ideas followed throughout the entire plant.

Besides all necessary small emery wheels and appliances for fitting up moulding cutters, cutters for matchers, shimmer cutters, etc., there is a very complete complement of other machinery. These include band, re-saw grinders, automatic circular and rip grinders, a large machine for grinding planer knives and an automatic grinding and setting machine for small band saws used on scroll work. Two men are kept constantly on this work.

Lumber Yard.

Another noteworthy feature of this plant is the fact that all lumber kept in stock is under cover, which generally comprises over a million feet. These sheds occupy the two sides of the rectangle 300x400 feet. They are 18 to 20 feet deep and 20 feet high. In the centre is another 100x250 feet, with a plank driveway through the centre, 22 feet wide, shown in the photograph. One side of this shed has been finished for stock sash and stock doors. The other side is double-decked principally for dressed stock, such as mouldings. This shed is one of the best of its class in Canada and probably has no superior on this continent.

The Staff.

The staff that work so harmoniously under Mr. Davidson is composed of the following gentlemen: Leander Henderson, manager and mechanical superintendent; Mr. Ouellette, in charge of refrigerator department; E. P. McGrath, foreman of the factory; Messrs. Frank White and Robert Massie, in charge of the estimating departments; Mr. Joseph Dawson, sales agent; and Mr. A. G. Rose, accountant.

The foregoing description can give the reader but a faint idea at best of the splendidly equipped and well organized plant of Jas. Davidson, of Ottawa, and it is not only a credit to Mr. Davidson, but an evidence of progress to the city of Ottawa as well as to the country at large.

THE NICHOLSON FILE CORPORATION.

HEREWITH will be found illustrated three extensive factories belonging to the Nicholson File Company. This company is operating seven large plants, including their Dominion works located at Port Hope, Ontario, giving employment altogether to over two thousand hands, manufacturing files and rasps exclusively. Their combined daily production exceeds 120,000 files and rasps of every size, shape and cut, and it is claimed that not only are they the largest manufacturers in the world but that their output is greater than that produced in the factories in England, France and Germany combined.

The Nicholson File Company was incorporated in 1864 by the late Wm. T. Nicholson, father of S. M. Nicholson, now president of the company, he having invented what is known as the increment cut file which rapidly superseded all other machine cut files, and is to-day preferred by expert mechanics to the best hand-cut files on account of their uniformity of cut and wearing qualities, consequently there is a growing demand for these files in all the large manufacturing centres of Europe, and the larger industries such as railroads, electrical engineering companies, and machinery manufacturers use the Nicholson increment cut files.

Although the Nicholson File Co. have purchased within the past six years nearly all the prominent file plants on this continent, they have not taken advantage of the situation and entered into any combine, neither have they advanced prices. On the contrary, the several plants which they now operate manufacture certain brands and kinds for which they are best adapted, with the result that they are now enabled to produce a very superior article at a much lower price than heretofore, and they are giving the consumer the benefit by supplying the different brands at very reasonable prices both on this continent and in foreign countries, and the result of forty-odd years' experience enables them to give an absolute warranty with all the goods manufactured by them. They have expended a large amount of money in connection with their Dominion works plant during the past three years and are now in a position to execute the largest orders promptly.

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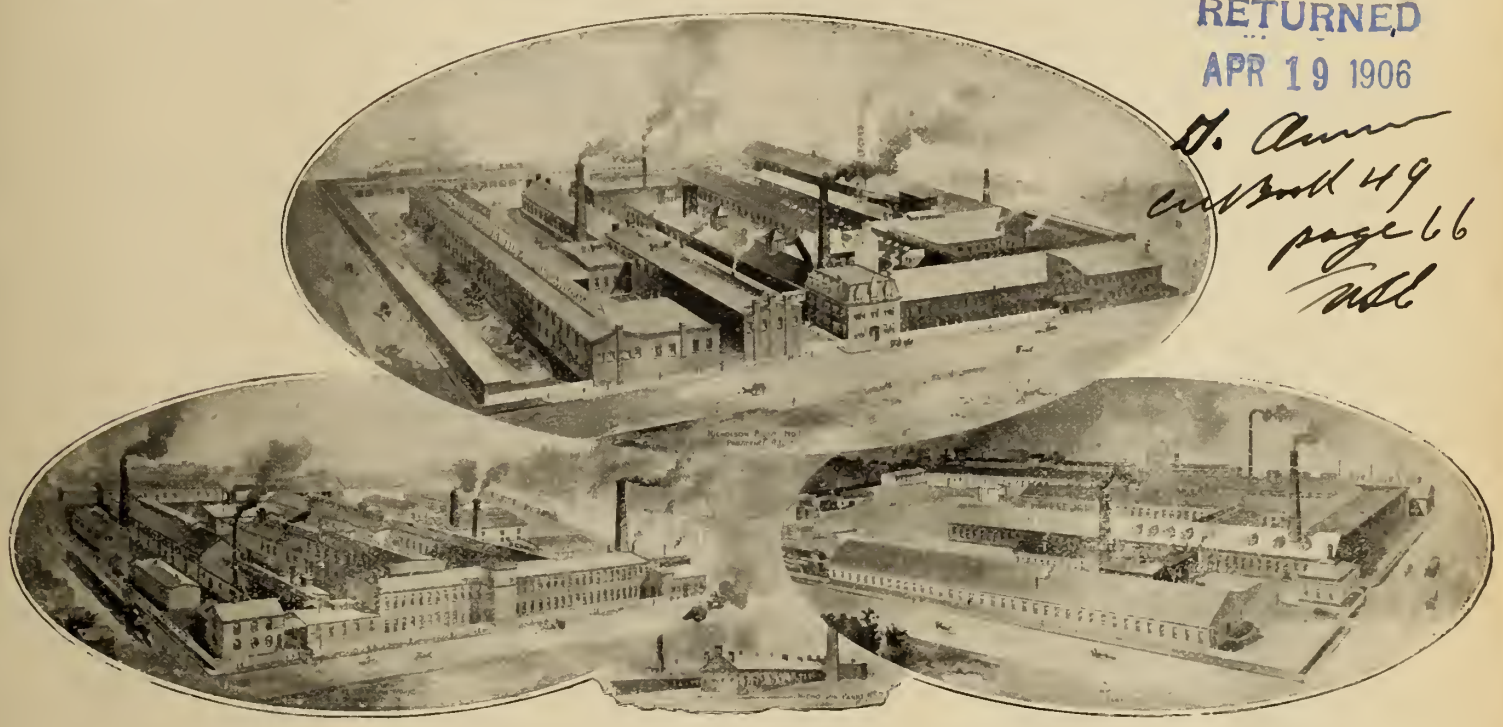

Works of the Nicholson File Company.

WORK AND WORRY.

"It is not work that kills men; it is worry. Work is healthy; you can hardly put more upon a man than he can bear. Worry is rust upon the blade. It is not the revolution that destroys the machinery, but the friction."—Henry Ward Beecher.

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NEW ADVERTISERS IN THIS NUMBER:

The Berlin Electrical Co., Berlin, Ont.
John Carr, Hamilton, Ont.
Chadwick Bros., Hamilton, Ont.
Economical Mfg. and Supply Co., Limited, Toronto.
Hamilton Facing Mills Co., Hamilton, Ont.
Hamilton Pattern Works, Hamilton, Ont.
E. Leonard & Sons, London, Ont.
Link-Belt Engineering Co., Philadelphia, U.S.A.
Peter Pilkington, Limited, London, Eng.
Standard Bolt & Nut Co., Toronto.
The McLachlan Gasoline Engine Co., Toronto.

THE WOODWORKING MACHINERY OUTLOOK.

EMPHASIS is given to the view that the outlook for woodworking machinery in Canada assumes a brightness unknown before by the fact that one of the largest manufacturers of this class of machinery is about to build a new plant double the capacity of the one now operated. At present there is a demand for high-grade woodworking machines that must continue as the country becomes settled northward into the timber districts.

An example of an as fairly equipped woodworking plant as may be found on the continent is described in the first article of this issue, showing the growth from a small beginning to a plant of which any city might be proud. The same possibility lies ahead of others who go about it in the right manner. The demand for the output of these factories is increasing, the raw material is to be had in unlimited quantities, and every month sees many such new industries commencing operations.

A visit by a representative of Canadian Machinery during the past month to the different manufacturers of woodworking machinery in Western Ontario reveals the fact that without exception they are enthusiastic over last year's business and glowing with the expectation of an increase even over the record business of the past twelve months for the year to come. The opening up of new districts both north and west suggests planing and saw mills at every centre. The immediate prospect is in British Columbia, where a hitherto unthought-of development is taking place, to which province consignments are going as rapidly as the machines can be turned out.

In regard to the design of new machines, it might be said that the tendency is decidedly in the direction of a heavier pattern. This began about six years ago with band saws, but not until within the past two years has the same been true of other standard woodworking machines. Cutting speeds have been increased, with the result that greater rigidity is imperative.

PRODUCING STEEL THERMO-ELECTRICALLY.

SAMPLES of steel produced directly from the ore, the first to be made in Canada, have been received by Mr. T. W. Gibson, director of the Ontario Bureau of Mines, from J. W. Evans, a mining engineer of Deseronto. One was made from the sulphurous ores of the Coe Hill Mine in Hastings county, and the others from titanium ore of the Horton Mine.

It is well known that an excess of sulphur reduces the value of iron ore to the point of making it next to worthless, depending on the percentage, and titanium renders iron ore extremely difficult to reduce. In view of this, the production of steel from such ores is all the more interesting and important.

However, it must not be lost sight of that this is merely a laboratory experiment, and demonstrates nothing regarding its commercial practicability. Some mild sensation has been raised over this, and possibly not without reason if from a scientific viewpoint alone, but until data and figures are available regarding the cost of producing steel in this manner it is useless to conjecture as to its effect on the steel industry of Canada.

GRANTED SPECIAL PRIVILEGES.

AT the meeting of the Engineers' Club, of Toronto, on January 11, a motion was passed extending to the editors of Canadian Machinery, and of other Canadian technical papers, "the privileges of the club rooms for the ensuing year."

Does the average reader appreciate the significance of this little act of courtesy? It is of enough importance to note in passing, for it serves to illustrate a point that some readers, and particularly some advertisers, frequently fail to grasp.

Why should the courtesy of the privileges of the club rooms of one of the most influential engineering bodies in Canada be extended to the technical press, and yet be withheld from the daily press? The answer is concise—because the members of the club have learned that the daily press is not in a position to deal intelligently with technical matters, and, further, that the technical press, in addition to treating the various subjects discussed intimately and intelligently, can be relied upon to cover the entire technical field. Moreover, they have learned that the technical man, the machinist, the superintendent, the engineer, the manufacturer, look for the technical news in the technical papers, not in the daily press, and so take this safe, as well as thorough, method of having the reports of their meetings placed before those interested.

To carry the query another step, what is back of this? The thought that the proper medium through which to reach the technical man is the technical paper. Moreover, the more progressive and up-to-date the treatment of technical matters the more influential and consequently the more effective the paper as an advertising medium.

QUALITY RATHER THAN QUANTITY.

CHARLES M. SCHWAB has uttered a note of warning to manufacturers in America regarding their output. A recent visit of his to the industrial establishments of Germany showed him clearly the reason of the German's success in the metal and other industries. Their love of research has taught them a thoroughness unheard of in this country. They aim at perfection, and are not satisfied until their object is achieved. Quantity with them is not thought of until quality is assured. They read and think and study and experiment, until some definite result has been attained. Himself a manufacturer on a large scale, Mr. Schwab was not slow to realize what the adoption of similar methods would mean in this country, and has already acted on his own suggestion regarding a better quality of output. He advocates more attention being paid to higher grades of manufacture.

Herein is a lesson for every manufacturer in Canada. With an ever increasing demand, our manufacturers are finding difficulty at times in keeping up with orders. Speed, economy of production, and quantity, are paramount, the inevitable result of which is a tendency to forget that quality should be the first consideration. We in this country cannot afford to overlook the object lessons of older established countries. Our prospects today are not excelled, and our resources are incomparable, but we must remember that even so we cannot lead in industrial pursuits unless we lay broad and deep the foundation of quality, and having secured this the superstructure of quantity will rise in towering strength.

EDITORIAL NOTES.

Unless the Ontario Government acts with promptness and decision regarding the validity of the Cobalt mining claims there is bound to be a regular furor of legal battles and much bitterness before matters are straightened out.

* * *

It is estimated that the value of the mineral output of British Columbia during last year was over twenty million dollars. The gold values were the greatest, being $5,750,000, followed closely by copper, at $5,400,000. Other minerals in order of value were coal, lead, coke, building materials and zinc.

* * *

Future generations will appreciate more, perhaps, than the present efforts of those who called together the Canadian Forestry Convention at Ottawa on January 10, 11 and 12. It is none too soon in our national history to commence a work that will provide an asset of no small amount in the years to come.

* * *

Interest is being aroused amongst lumbermen in Cambria county, Pa., towards the timber wealth of Ontario. Two gentlemen have been in Toronto recently from that district with a view to finding out the opportunities for investment. They represent interests prepared to spend from $500,000 to $1,000,000 in lumber operations in Canada.

* * *

In spite of the unfavorable outlook during the first three months of the past year, the railway companies found it the best in their history. Snow blockades and consequent cessation of traffic augured ill at the commencement, but enough subsequent business was done in excess of other years to make nineteen hundred and five the banner year in railway circles.

* * *

Attention is called to a series of articles, commencing with this issue, on the "Improvement of the Steam Boiler," by Mr. Peter Bain, designing engineer of the John McDougall Caledonian Iron Works, Montreal. The subject is one upon which the author, from his wide experience, is well calculated to write, and is essentially of interest to all users of steam power.

* * *

According to one of the daily consular and trade reports, issued at Washington, Turkey is ready to import agricultural implements of all kinds, and many lines of machinery, including flour mill, mining, laundry, small ice making, grain cleaning, wood working for doors, sash and blinds, cotton gin, box making, etc. The great demand is for simple machines of small dimensions.

* * *

Beautifying towns and cities in Canada is a live topic at present. The employes of Goldie & McCulloch Co., Galt., have gone at the matter in the proper manner by forming a society with that in view, wherein each member undertakes the individual responsibility of improving and making attractive his own premises. Other towns might follow this initiative to their material advantage.

HENDERSON ROLLER BEARING MIX-UP

Auditor's charges, says President Simpson, may mean Penitentiary for R. I. Henderson.

A sensation has been created in manufacturing and investment circles during the past month in connection with the affairs of the Henderson Roller Bearing Co., of Toronto, resulting in an airing of the business in court, where some lively and dramatic scenes ensued and where startling evidence was given.

As a result of writs issued against the company, a winding-up order was granted by Chief Justice Falconbridge on Saturday, Jan. 13, but on the following Monday, on the application of another petitioner, a stay in proceedings was allowed. This gave a chance to have the principals in the case make their statements in court, these being D. Burke Simpson, president, and G. F. Marter, vice-president, who maintained that the company as it existed was hopelessly insolvent, and A. E. Henderson, secretary, who denied that this was so.

Pending this decision, permission was given the shareholders to hold a meeting which was called for Friday, Jan. 26, when a reorganization was recommended in preference to liquidation. As far as all evidence goes, the affairs of this company are certainly in a bad way.

To go into history, about five years ago A. E. Henderson, then a Methodist minister of Woodbridge, secured the patent for the invention that now bears his name. Business men of Woodbridge, together with some Toronto capital, formed a company, to exploit this bearing, called the Toronto Roller Bearing Co., with a capital of $40,000 in shares of $100 each. After some experimenting and procuring patents in almost every civilized country in the world, the idea was conceived of making this the parent company to sell the rights to other companies to manufacture the patent, which at this time had not been given a really satisfactory commercial test.

The next step in the affairs of this organization was when the Henderson Roller Bearing Mfg. Co. was formed, capitalized at $1,000,000, to take over the patent rights for Canada only and manufacture the bearings in this country. They were to pay the parent company for this privilege $500,000—$100,000 in cash and $400,000 in stock in the new company. The stock of this new company was boomed and advertised in such a manner that single shares rose in value to over $125, during which time some goods were manufactured, but which, according to the statement of some of those interested, were being placed on the market at a fraction of their cost to manufacture. It was apparent to some of the shareholders that matters had not been going satisfactorily, as, according to the statement of Mr. Marter, the board of directors had lost confidence in Messrs. Henderson and the managers were asked to resign. The officers all sent in their resignations with the exception of A. E. Henderson, then secretary and treasurer, who asked that he be left with the secretaryship. A new management was appointed, with D. Burke Simpson as president, G. F. Marter, vice-president. The balance sheet issued on Nov. 30, 1905, is of interest. It shows $478,000 of stock paid in, with assets of $117,000, and liabilities of $45,000, leaving nominally $72,000 of assets besides the alleged value of the patent to answer the $478,000 of stock paid in. The statement shows the value of this to be $500,000 as a cash asset, giving the company, by the statement, a contingent reserve of over $93,000. The question many of the shareholders asked was, what became of this large amount of money, since no showing of this appeared in the statement.

Matters became more and more unsatisfactory to many of the shareholders, resulting in a number of writs being issued against the Henderson Roller Bearing Co. on the ground of alleged misrepresentation, as a large number of the shareholders bought their stock with the proviso, "We hereby agree that if you are not satisfied with your holdings of this stock, after twelve months, we will give you back your money with 25 per cent. advance and 10 per cent. for the money during the time we have held it." Signed with the rubber stamp of the Henderson Roller Bearing Co. per R. J. Henderson, manager.

In view of the number of these writs, the winding-up order was issued by Chief Justice Falconbridge on the recommendation of the financial statement issued by Messrs. Simpson and Marter. In the proceedings to set aside this winding-up order, the company's affairs were placed in the limelight of public attention for some days, the conspicuous features of which were the bitter denunciation by Messrs. Simpson and Marter of the Henderson mis-management of the company. It was stated by Mr. Marter that the company had been going behind between $4,000 and $5,000 a month and that for over $400,000 invested there was only $30,000 worth of business done. An affidavit filed at Osgoode Hall by Auditor Edwards, of the company, estimates the loss in the manufacturing end up to Nov. 1 of last year to amount to $80,000. It was claimed by A. E. Henderson that Messrs. Simpson and Marter had acted in bad faith in placing the affairs of the company before the creditors. The question was adjourned until the meeting of the shareholders should have taken place, which was done on Friday, Jan. 26.

At this meeting serious charges were made by the officials of the company, the discussion lasting from 9 o'clock in the morning until nearly 7 o'clock in the evening. G. F. Marter opened the business proper with a speech of a condemnatory character in which he declared the company to be hopelessly insolvent. He was followed by a speech in similar vein by Mr. Simpson, in which he stated that the company was not only insolvent, but that the invention was useless. A. E. Henderson, inventor of the bearing, spoke for more than two hours, when he attempted to vindicate the character of the invention.

An evidence of the seriousness of this discussion is seen in the fact that in speaking of their desire for an audit, Mr. Simpson said that the auditor had made charges that meant only one place, and that the penitentiary, for the manager, R. I. Henderson. "We paid $21,000 and there were $31,000 of debts at the time Mr. Henderson said there were only $1'4,000." They had not been able to get the particulars regarding the new building being built by the new company, and when built he did not know what the factory was to do, as a traveler had come in, after being all over the country, with a single order of $40.

In his defence, A. E. Henderson said that it was unfair to have his brother appear as receiving large sums of money unjustly. Money had to be expended for the promotion of any enterprise. He showed a list of orders that had been received before the present crisis had arrived. The financial statement given at the meeting of the audit of Edwards, Morgan & Co., made on the suggestion of Chief Justice Falconbridge, as submitted by Mr. Marter, is in part as follows:

RECEIPTS.

Allotted on patents.....	$200,000.00
Calls paid	261,255.00
Premiums paid	23,270.00
Share notes	18,450.00
Credit for machinery	19,094.82
Borrowed	25,678.20
Sales, $47,915.19, less amount outstanding....	35,363.16
	$583,111.18

Of this amount $346,678.31 is represented by: Patents, $240,272, and the balance in machinery, tools, drawings, fixtures and buildings, the latter amounting to $23,654.53. For $236,423.46, no assets remain.

Against this must be set income of $61,585.19, leaving a new impairment of capital $175,703.27.

Pending a final decision, the court adjourned the case from Monday, 28th inst., for three weeks, in order that all possible chance be given the shareholders for a reorganization.

Some confusion has arisen in the minds of many regarding the manufacturers of anti-friction bearings, with the result that the names of other firms have been associated with this one. It might be said that there are two other firms manufacturing anti-friction bearings, namely the Chapman Double Ball Bearing Co., of Toronto, and the Canada Bearings, of Hamilton, neither of which has any connection whatever with the Henderson Roller Bearing Co.

ENGINEERING NEWS

AND BUSINESS NOTES

SOCIETY OFFICERS.

Canadian Society of Civil Engineers.

Officers for 1905: President, Ernest Marceau, Montreal; treasurer, H. Irwin; secretary, C. H. McLeod. Rooms: 877 Dorchester St., Montreal.

Canadian Mining Institute.

President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer Lamb, Victoria, B.C.; treasurer, J. Stevenson Brown, Montreal.

Toronto Branch A. I. E. E.

Chairman, H. A. Moore; vice-chairman, R. G. Black; secretary, R. T. McKeen.

Marine Engineers.

Grand president, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N.B.

Engineers' Society, Faculty Applied Science, Toronto University.

President, T. R. Loudon; recording secretary, F. A. McGivern; treasurer, B. W. Marrs; corresponding secretary, C. S. Shirriss.

Canadian Electrical Association.

President, A. A. Wright, M.P., Renfrew, Ont; vice-presidents, R. G. Black, Toronto, John Murphy, Ottawa; secretary-treasurer, C. H. Mortimer, Confederation Life Building, Toronto.

Canadian Association of Stationary Engineers.

President, Wm. A. Sweet, Hamilton; vice-president; Jos. Ironsides; secretary, Wm. Outhwaite, Toronto, conductor, Ed. Grandbois, Chatham; doorkeeper, Chas. Kelly, Chatham.

Ontario Association of Stationary Engineers.

President, Geo. Fowler, Toronto; vice-president, W. F. Chapman, Brockville; treasurer, Charles Moseley, Toronto; registrar, W. G. Blackgrove, Toronto

Canadian Railway Club.

President, S. King; secretary, James Powell, chief draughtsman motive power department, G. T. R. treasurer, S. S. Underwood, chief draughtsman car department, G. T. R.

Engineers' Club of Toronto.

President, F. L. Sommerville; treasurer, W. J. Bowers; secretary, Willis Chipman, Rooms 96 King St. W.

Engineers' Club Annual Meeting.

AT the rooms of the Engineers' Club, of Toronto, the seventh annual meeting was held on Thursday evening, January 11, at which there was a large attendance of enthusiastic members, with Mr. R. F. Tait, president, in the chair. The report of the executive committee showed a membership of 145, and further pointed out the fact that the past year had been an unusually prosperous one for the club. The report of the treasurer showed a balance of $713. During the year the opening smoker had been held, and the club's annual dinner, both of which were an unqualified success. The reports of the various committees all went to show the progress made by the club. The committee for revising the constitution was appointed, consisting of Messrs. Bowers, Gemmill, Sommerville, Tait, Canniff, Smith, and Chipman. The election of officers resulted as follows: President, F. L. Sommerville; first vice-president, C. B. Smith; second vice-president, J. G. Sing; directors, J. S. Fielding, A. M. Wickins and C. M. Canniff; treasurer, W. J. Bowers; secretary, Willis Chipman.

The privileges of the club were given to the editors of Canadian Machinery and other technical papers in Canada, for which courtesy the thanks of this paper are herewith extended to the Engineers' Club.

The event of the evening was the reading of the retiring president's valedictory address, in which Mr. Tait gave a rousing resume of engineering progress in Canada during the past year.

Mr. F. L. Sommerville,
President-Elect Toronto Engineers' Club.

He pointed out that Canada had every reason to be proud of the industrial development during 1905. Particularly was this noticeable in steam railroad work, an eloquent portrayal of which was given, showing the commencement of the Grand Trunk Pacific, the completion of the Canadian Northern to Edmonton which was finished very recently, the advances made by the Canadian Pacific, the double tracking of the Grand Trunk Railway from Montreal to Sarnia, and the building of 150 miles of the Temiscaming & Canadian Northern Railway by the Canadian Government, the chairman of the Railway Commission being Mr. Cecil B. Smith, a member of the Toronto Club. The wonderful electrical development at Niagara was given some prominence, in which the speaker pointed out that there was already on the Canadian side 60,000 h.p. available for manufacturers, and that there would soon be 400,000. Next to this was the work done at De-Cew Falls, near Hamilton, where 40,000 h.p. could be developed. Another important step in this line was the power at Port Arthur, where a drop of 120 feet was being utilized. Among other places where additions had been made were Lachine, Chambly, and Shawinigan Falls. Then, again, there had been no uncertain step in the steel rail industry. Canada was now making steel rails of the highest grade, and unable to supply the demand, Bessemer rails being made at Sault Ste. Marie and open hearth rails at Sydney. Along the line of structural work four large firms were located at Walkerville, Hamilton and Montreal, turning out the finest class of engineering and building construction. In locomotive building important strides had been made. Ship building had made some advance, there now being works located at Collingwood, Port Colborne and Toronto. Although little had been done in extending our canals, this was something that was bound to materialize with the further development of the country. It was impossible to go into the engineering details of British Columbia, the northern country and the Maritime Provinces, but it was with enthusiastic pride he was able to chronicle the awakening in his beloved country of an area of progress such as she had never before seen.

A pleasant feature of the evening, following the chairman's address, was the presentation of an alligator traveling bag to Mr. Willis Chipman, the energetic and untiring secretary of the club. Refreshments were then served, after which the meeting was adjourned, all present voting it one of the best that the club had yet had.

* * *

Invitation to England.

An invitation has been received from the Institution of Electrical Engineers of Great Britain by the secretary of the Canadian Electrical Association, extending to the members of the latter society a cordial invitation to visit Great Britain in 1906, as guests of the institution. While this invitation is highly appreciated by the association, it is regretted that it is impossible to organize a special party, although no doubt individual members will avail themselves of the kindness of their British electrical friends.

GOOD COMPANY.

"Associate with men of good judgment, for judgment is found in conversation, and we make another man's judgment ours by frequenting his company."—Fuller.

Natural Selection Applied to Industrial Arts

Or the Law of the Survival of the Fittest

By Egerton R. Case, Solicitor of Patents, Toronto.

(Registered in accordance with the Copyright Act.)

IT occurs to me that it would be of considerable interest to draw a parallel (as far as possible) between Darwin's law of natural selection, or the law of the survival of the fittest, and the best rule for an inventor to follow in inventing, so as to prove the procedure I (and perhaps others) advocate embodies a law that is constantly at work in organic beings.

Preservation of Elements.

Darwin defines natural selection as implying the preservation of individual differences and variations that arise and are beneficial to the being under its conditions of life, and the destruction of those which are injurious.

There are gradations in the state of perfection in the development of an invention, as truly as there are gradations in the state of perfection in the development of organic beings ; and it is only through a thorough knowledge of such "states of perfection" that an inventor can reach the highest success.

As is well known, all the modified descendants from a widely diffused species, belonging to a large genus, will tend to partake of the same advantages which made their parents a success in life ; the same way with inventions belonging to the same class ; therefore, the law of industrial arts development implies the preservation of those elements and process steps that are beneficial to the invention, the discarding of those elements and process steps that are injurious thereto, and the combining with the beneficial elements or process steps new elements or process steps that will make the invention a modern success.

Ideal for Inventors.

According to the spirit of this article, the inventor would naturally take up the art he is most familiar with, and pick out therefrom some invention (and there are many of them) that has failed for want of some improvement to be most valuable. By studying carefully the state of the art relating to this invention, the inventor will have before him the elements that have made each succeeding invention a success over the immediately preceding ones, and will then have the foundation for the development of further steps. In other words he will possess the genealogical succession, so to speak, of the beneficial elements chosen from the prior state of the art, new elements that will make the invention a modern success, and thus follow after an industrial manner the law at work in nature whereby organic beings are developed and equipped so that they can best exist under the then existing conditions of life. By following further this law, it is apparent that new genera and species of inventions will of necessity be developed from time to time, as are new genera and species developed in organic beings.

The charge may be laid against this plan that it would tend to make inventors less original, that is, cause them to copy too closely the existing inventions in the prior art. But careful thought will dispel this belief, as above noted. Even if an inventor determines to work upon the original lines, he must acquaint himself with the prior state of the art, in order that he may successfully keep away from the beaten paths of prior inventors.

It is well known that for every generic invention, there are many secondary inventions. So it is perhaps in connection with secondary inventions that a knowledge of the law set forth in this article will be most useful.

When an inventor goes blindly to work, that is, without any knowledge of the prior state of the art, he spends much time and money in traveling well-beaten paths made by the patient toil of previous inventors ; whereas, if he followed out the plan herein set forth, he would soon acquaint himself with the successful and unsuccessful steps made by his predecessors, and act accordingly ; this is an indisputable fact.

Because an inventor finds that all through an art certain elements therein have been retained, it does not follow that he need combine these elements in the same manner. The requirements of the case will, of course, determine this, coupled with the inventor's mental capacity.

Relation to Darwin's Law.

I do not say that, between my statement of the law to be observed in developing inventions, and Darwin's law above cited, there is a complete parallel. The inventor, of course, has more immediate freedom in his choice of combination of elements than if he were working through a process so slow as that of natural selection. But it would seem that he is bound to recognize and adopt those elements in prior inventions that have contributed to, or that have been the sole cause of, the success of same.

It is well known that inventors oftentimes find great difficulty in making improvements or fully developing their inventions in order to make them commercial. When these periods or states of non-development are taken into account, it appears to me that there is quite a parallel between the development of an invention (particularly a complicated one) and the law of natural selection. When the inventor cannot at once make the step or improvement he wishes, it naturally follows that he cannot draw upon his past experience, and his knowledge of the prior state of the art, in order to supply that defect ; consequently a mental process (which I might term mental natural selection-inventing) must be gone through before the inventor can arrive at the result he is aiming at. The more fertile the brain in which the idea has lodgment, the quicker will the mental powers absorb, so to speak, that idea, and give birth to it in concrete form. So likewise in the development of the organic being ; the more suitable the conditions, the quicker will a genus or species be developed that can best exist under the then existing conditions of that period of life.

The Natural Invention.

As natural selection will never produce in an organic being any structure more injurious than beneficial to that being, it follows that when an inventor proceeds along the right lines of development, he will naturally use elements that will always contribute to the success of the invention. Natural selection tends only to make each organic being as perfect as, or slightly more perfect than, the other inhabitants of the same country with which it comes into competition. Consequently the properly-directed efforts of an inventor must essentially produce as good or better an invention than those prior thereto, and with which it must inevitably come into competition. The chances are greatly in favor of a better invention being produced, as all inventive effort is exercised for that very end.

If I have touched upon a method of development well known of organic beings so as to try and prove to inventors that there is an easier or more natural method of reaching their goals than is now generally practiced, and succeed ever so little, I shall be content. When

we look around us and consider what humanity at large owes to the inventor of all nations, we must acknowledge our great indebtedness to him. His success is many times purchased by the practice of great personal privations, and often without reaping the rewards his heroic and unselfish efforts have merited.

Many inventors will ask how they are to get knowledge of what inventions have been already made in a particular art. The best way to procure this information is to get copies of all the patents granted in that art.

As certain as day follows night, if an inventor proceeds in his investigations after the manner I have endeavored to prove to be the correct one, he will obtain the maximum success with the minimum expenditure of time and money.

What I have herein stated relative to the development of the industrial arts applies with equal force to the development of the fine arts.

Improvement of the Steam Boiler

By Peter Bain.*

NECESSITY for the best in steam boiler material, design, workmanship, management, legislation, supervision and inspection is certainly more urgent in these opening years of the twentieth century than it has been since its introduction and development as a mighty factor in the evolution of the civilized world. Unlike its contemporary, the reciprocating steam engine, the zenith of almost practical perfection has not been reached, nor has its existence been so seriously and successfully challenged. The steam turbine, rapidly superseding the reciprocating steam engine, gives continuity (I am almost disposed to call it permanency) to the steam boiler, making at least equal demands on its strength, safety, weight, compactness, efficiency and capacity, and opening up more extended spheres of usefulness.

This, I take it, calls for the application of increased ingenuity, skill and conscience on the part of those interested. Affecting as it does the convenience and safety of the public, the competitive platform of the boiler manufacturer, the maximum return in efficiency and economy to the steam user, the quality of the steel works output, the education and training of designers, tradesmen and attendants, the most suitable tools and appliances, it is apparent no apology is necessary for discussing through a series of articles in Canadian Machinery this important and far-reaching topic.

Differences of opinion exist all the way through as to the rightness or wrongness of certain conclusions (proved or otherwise) which regulate certain courses of action. Of these I am perfectly aware, yet although suggestions here thrown out may jar on minds as competent and more so, as long experienced and more so, than that of the writer, it is to be remembered that we are not the whole show, that a young generation of engineers and boilermakers is growing up around us, alert, prying, pushing, with heads clear, minds unbiased by familiarity and experience, open to test and prove, and put into practical and progressive effect what is best in their instruction and reading, and what will certainly make for improvement.

Again, it is necessary, even at this late hour of the day, to enlighten, in addition, the general public and allied and associated trades, having already preconceived ideas and opinions in large measure erroneous, such ideas and opinions being nothing more or less than conclusions that because a steam boiler is uncomely to an untrained and inexperienced eye, is devoid of polish and glitter so necessary in the artistic, is minus other (in its case) useless adornments, any conglomeration of plates and rivets (so long as weight is assured), thrown together by a handy man, constitutes all there is to it.

The first article will discuss the important question of

Legislation.

Legislation is absolutely necessary and should in each country be the law for all. Were this consummation reached nationally, the step to international codes of rules would be easily attainable, for the steam boiler is to all intents and purposes the same the world over, and the same ideal perfection is sought. Such legislation, then, from the national standpoint, and not from the provincial and civic, is really the main point, and in so far as it affects our Dominion, let me refer to it. It should be the expressions of a council of representative men, a commission if you like, whose patent of being has the seal of state, whose deliberations and conclusions are untrammelled by such seal, and whose integrity of character and fitness for the work are beyond question. Such men are no "rara avis" in the engineering world, and their recommendations and findings incorporated in the statute book would tend mightily towards an ideal boiler.

Our Canadian Manufacturers' Association, an organization which has the best interests of our country at heart, is to my mind best fitted to put this question on a proper basis. Could not a section of those directly concerned, supplemented by the addition of the expert advisers of each individual manufacturer and consulting engineers of authority and repute be constituted? Codes of rules, the outcome of the deliberations of such a body, backed by the weight of the whole manufacturers' association, could not fail to have the support of the public, and would consequently become law readily. Existing rules there are in abundance, yea, in superabundance, and it is just here that the weak spot is.

The law for the east should be the law for the west, the law for the city that of its suburbs, and the enforcer of the law, representative government advised and guided as stated. Those who guard the law should be men of honor, fearless in the discharge of their duty, and those who manufacture should respect the law to its uttermost limit. Much hard work lies before such a commission. Much wrangling and discussion is ahead. Many imperfections, which time only will eradicate, will be apparent in the rules, and particularly to those persons whose pet ideas have not been incorporated; but out of all a much improved boiler will be evolved, and what is not of little importance, a fairer and more satisfactory competitive manufacturers' platform will be established, a point in its ultimate bearing which affects everybody more or less.

Young, then, though we be as a manufacturing country, it may be our lot to set up the basis from which international codes of rules will govern all steam boilers, and there is no reason why we should not be in the forefront. We have resources unlimited as a country, and as individuals we have a fair share of genius, ability, experience and push. While water power, on account of our natural resources, will necessarily be largely utilized, and electrical power also play an important part, it remains that steam power there must be, and to the extent of the adaptability of our generator will be the extent in our country's development of the part it will play.

* Designing Engineer, John McDougall, Caledonian Iron Works, Montreal.

Designing a Wood-Working Molder

By T. C. Robertson.

ARTICLE II.

ATTENTION was called in January article to the belting of molding machines from rear end and some of the advantages derived therefrom. Going more fully into this we find by reference to the accompanying diagram a

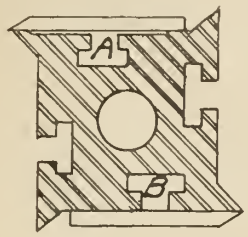


FIG 1

marked advantage upon the wear of cutter head bearings.

First let us note carefully the effect of the pull of knives as they enter the cut and we will see the pull is downward, thus bringing pressure upon bottom part of bearing. The pressure is increased or diminished according to manner of belting, as will be seen by consulting diagram. In belting from front end, the tight side of belt shows a pressure upon bottom side of bearing in addition to that effected by knives and therefore causing greater trouble in wear and heating. In belting from rear end, the pull of belt is in the opposite direction and relieves pressure caused by pull of knives in cutting. There seems to exist in the minds of many operators of wood-cutting tools a misconception regarding the wear caused by the work done. A careful examination of bearings after cutter-head journals have been removed

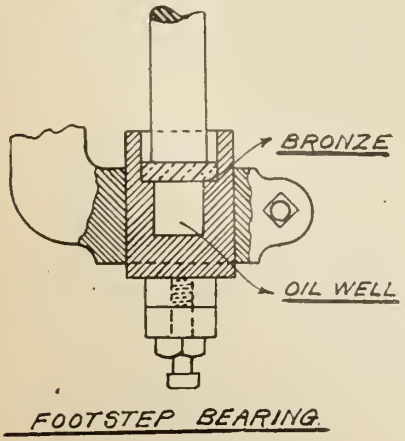


Fig. 2.

will show that the cap has been subjected to very little wear, even in cases where pull of belt has been in direction of cap. The fact is the only time when wear occurs on cap is when there is no cutting done.

Another important advantage gained by belting from rear is an increased amount of power obtained from belts which run side heads. By having the belt delivered in a straight line from side head pulley a perfect contact is obtained, thus giving a larger percentage of power. The power of belt is also increased by the use of pneumatic pulley shown in diagram. It consists of a spiral groove which extends around the face, connecting with exits for the air to pass from between belt and face of pulley. The advantage of this must be apparent when we know the belt hugs the pulley ever the entire bearing surface, with no air cushion to interfere, thus giving according to actual test a gain of about 30 per cent., besides preventing heating of bearings.

Another important feature that should be considered in molder construction is the design of cutter-heads. It will be noticed by referring to Figure 1 that the cutter-head and knife do not come in contact at (A). When bolted down there is a firm and close contact next to cutting edge, thus preventing any possibility of shavings packing in between knife and head. The old method of fastening is shown on same figure at (B), and experience shows that in some kinds of wood, shavings will pack in directly under cutting edge and sometimes strain knife to breaking point.

The footstep bearing for side heads of molders has received much attention from designers, and a number of devices have been adopted to insure a bearing which will endure the wear and avoid heating. The accompanying diagram shows one which has given good satisfaction in every particular. Attention has been already called to the advantage gained by belting from rear of machine, and among these is a minimum of wear upon footstep bearing, as the downward pull is in a large measure eliminated.

The bearing consists of an adjustable step containing a bronze bearing beneath which there is an oil well which supplies oil through a wick inserted into suitable grooves in bronze bearing and terminating in oil well, causing a constant circulation of oil to surfaces of contact. Very little attention is required after supplying oil to reservoirs.

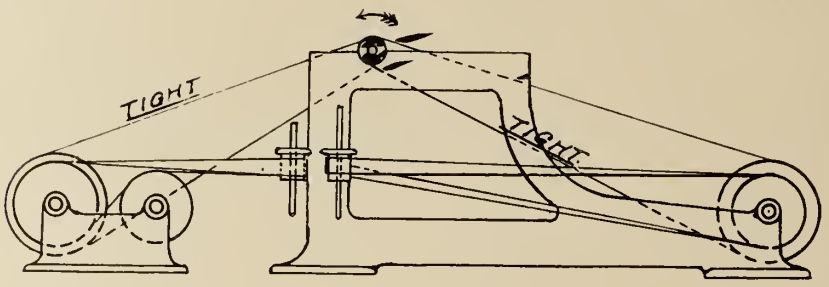


Fig. 3—Belt Arrangement..

DURHAM CEMENT WORKS.

Reference was recently made to the proposed removal of the cement mill belonging to the National Portland Cement Co., at Durham, to some other point, owing to a supposed absence of raw material in that district. The mill has since been closed down and a hot time is promised at the annual meeting which is to take place soon. The company was originally organized about three years ago, the promoters taking one-quarter of the million dollars capital as their remuneration for floating the concern. During the first couple of years about $700,000 was sunk in buildings, plant and experiments, and stock fell to rock bottom figures. Last year, however, the company did business at a considerable profit, and as an investigation has proven that there is a large supply of high class marl near Durham, the local stockholders who have their money invested in the enterprise, are securing proxies and preparing to oust the present directors, and install a new board who will continue the present works and endeavor to produce a dividend for the stockholders.

FRIENDSHIP.

Get not your friends by bare compliments, but by giving them sensible tokens of your love. It is well worth while to learn how to win the heart of a man the right way. Force is of no use to make or preserve a friend, who is an animal that is never caught nor tamed but by kindness and pleasure. Excite them by your civilities, and show them that you desire nothing more than their satisfaction; oblige with all your soul that friend who has made you a present of his own.—Socrates

Practical Mechanics

By W. H. Raeburn

Article IV. A descriptive discussion of an important subject, simply and clearly stated. Every article of this series should be read and studied by all readers of Canadian Machinery. They are practical and helpful.

THE LEVER.

LEVERS in their various forms enter so largely into the construction of machinery that more than passing attention should be given this mechanism. We have heard of devices invented by those who seek to reach such unattainable ends as perpetual motion and power multiplication, and we can find in some such devices levers used in ways that betray the lack of knowledge on the part of the inventor of the simple law of the lever. Nor do we require to enter the field just mentioned to find mistakes; they stumble into what we might term legitimate machine design occasionally. We have learned from previous articles that there is a difference between force and power, using these terms in their proper sense, yet they are used rather indiscriminately by practical men.

We can exert enormous force by the use of a lever—a man can move many tons—but we never increase power, using this term in the sense of work which we now understand to mean force multiplied by distance.

Proving a Law.

By making a few simple observations we shall find that the following principle always holds good in levers, as indeed in any of the other mechanical powers: The work done at the point of application of the power equals the work done where the load is applied, remembering that in this law friction is ignored, a condition which of course is not met with in practice.

Take a light piece of wood three feet long and balance it at a point one foot from one end, as shown in Figure 1. It is necessary in order to obtain satisfactory results in the present case either to counter-balance the lever before ap-

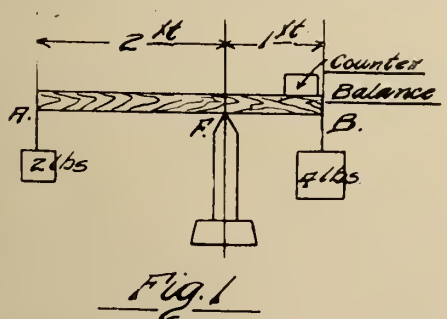


Fig. 1

plying any loads or to take its weight into consideration in our calculations, which latter method complicates matters a little for a beginner, so we shall assume the lever as being properly counter-balanced when supported as shown. Suspend a 2-lb. weight at (A) and it will be found necessary to use one of 4 lbs. at (B) in order to keep the lever in balance. As will be readily understood, the balance is disturbed by the slightest addition to either weight. If the 4-lb. weight descends 1 inch it is clear that the 2-lb. weight will go up 2 inches. This is apparent without mathematical reasoning, which, however useful, we feel constrained to avoid in these articles.

The work done by the 4-lb. weight in decending 1 inch is $4 \times 1 = 4$ inch lbs., and that done at the other end of the lever is $2 \times 2 = 4$ inch lbs., thus demonstrating the law known as the principle of work. A few simple experiments and a little reasoning will teach us that the weights will always be in inverse proportion to the length of the arms of the lever, provided that the lever itself is properly counter-balanced so as to eliminate its weight from the calculations.

Principle of Movements.

We have another and more common method of approaching lever problems,

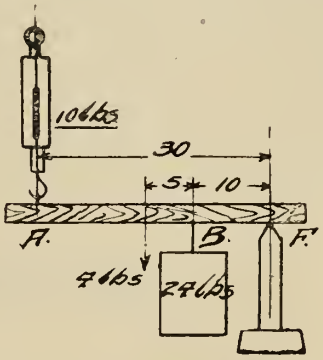


Fig. 2

by way of the principle of moments, which we shall now consider. Our lever is horizontal and the forces represented by the action of the weights act along vertical lines and therefore at right angles to the lever. The moment of the force at (B) with regard to or about the fulcrum (F) is 4 lbs. multiplied by 1 foot equals 1 ft. lbs., and the moment of the force at (A) about the same point (F) is 2 lbs. multiplied by 2 ft. equals 4 ft. lbs.; thus the moments of the two forces are equal and we can reason from this that the moments of the forces tending to turn the lever in one direction must be equal to the moments of the forces tending to turn it in the opposite direction in order to maintain equilibrium. In a simple lever this easily remembered law covers all cases where the weight of the lever is either neglected or counter-balanced—the product of one force and its distance from the fulcrum equals the product of the other force and its distance from the fulcrum. This law holds good in every kind of lever no matter in what relative positions the fulcrum and points of application of the forces are placed or whether the arms of the lever are in the

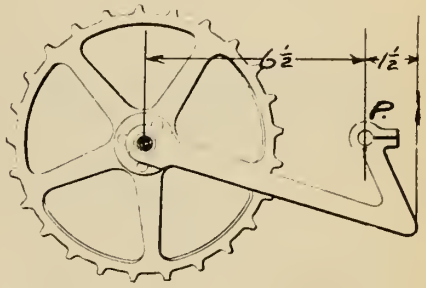


Fig. 3

same straight line or make an angle with each other. We must always see that the distances from the lines of direction of the forces to the fulcrum are measured at right angles to these lines of direction.

In Figure 2 is shown a different arrangement from that in Figure 1. We cannot so easily counter-balance the lever in this case so we shall utilize the experiment to explain how the weight of the lever is taken into consideration. Assume that this weight is 4 lbs. and acts through the centre of the bar or 15 inches from the fulcrum. We have now two forces tending to lower the lever and one tending to raise it, the latter being measured by means of a spring balance. The moments of the two downward forces are $24 \times 10 = 240$ in. lbs. and $4 \times 15 = 60$ in. lbs., making a total of 300 in. lbs. The moment of the upward force at (A) must equal this. The distance from the fulcrum at which this force acts is 30 in., so that

$$\text{the force must be } \frac{300}{30} = 10 \text{ lbs.}$$

These elementary examples illustrate the general principles underlying the use of levers in their many forms. Two of the most common modifications of the lever are the wheel and axle as found in hoisting machinery and toothed gearing

(*Continued on page 86*)

An Innovation in Type-Composing Machines

IT seems almost incredible that after the scores of type-composing machines invented in the past fifteen or twenty years, one can be produced which differs not only in its basic principle from all previous inventions, but also opens up a new field for machine work in the printing industry, and still more incredible that such a machine can be made less complicated than any heretofore built. Yet such are the claims of the little type-casting and composing machine just invented by Messrs. John R. and Gustave A. Pearson.

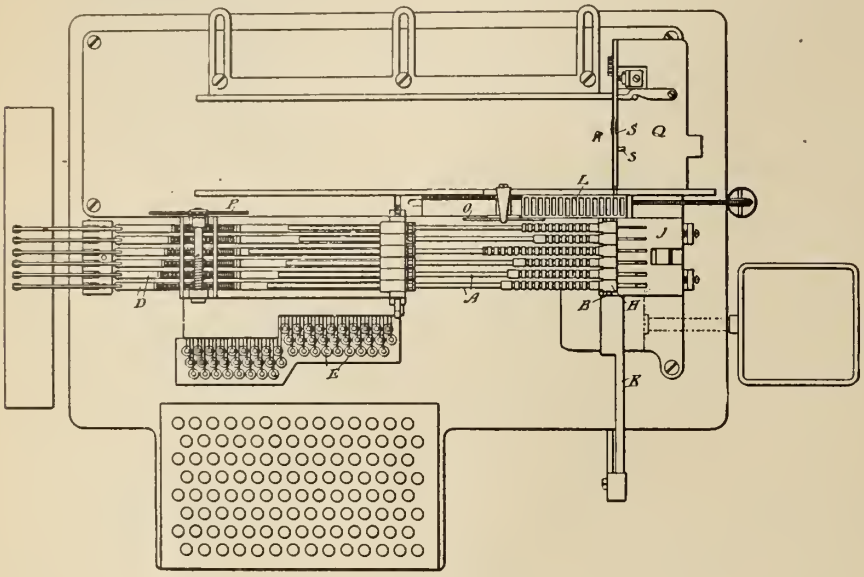


Fig. 1—Front Elevation with the Keyboard Removed.

Aim of Inventors.

The primary purpose of the inventors was to provide a machine which would be used for setting advertisements. This required that the machine should cast single character types and should carry matrices of a number of different fonts. A secondary, though hardly less important aim, was to make the machine so simple and inexpensive that it could be brought within reach of those smaller printing offices which still cling to hand composition, owing to the high cost of the complicated machines now on the market. Undoubtedly the one thing that has stood in the way of simplifying these machines is the custom demanding that all lines of a column should be of exactly the same length, excepting, of course, such breaks as occur at the beginning and end of a paragraph. The operator of a machine obviously cannot determine until after the words of a line have been set how many spaces will be required to justify the line and how thick the different spaces must be.

There are two prineipal methods by which the justifying of the lines has been done. In certain of the machines the matrices are assembled for the entire line with adjustable space bars between the words, after which the line is automatically justified and cast in a single slug. In others a ribbon of paper is perforated in response to the keys of the keyboard, and at the end of each line the width of the spaces necessary to justify that line is automatically recorded by a combination of perforations. The perforated ribbon is then run backward through a separate machine which casts single character type and spaces as selected by the perforations. The purpose of running the ribbon through backwards is to adjust the space-casting mechanism for each line before the casting is done. In neither the line slug nor the individual type machine is any casting done until the keyboard has been operated for at least an entire line. The main objection to the first system is that in making corrections individual types cannot be removed and replaced with new ones, but entire lines must be thrown away and entire new lines composed and cast. The system is further unsuited for ad. composition, owing to the frequent use of two-line type requiring constant variations in the length of the lines. On the other hand the second system is objectionable as it requires two machines and two operators to compose and cast the type matter.

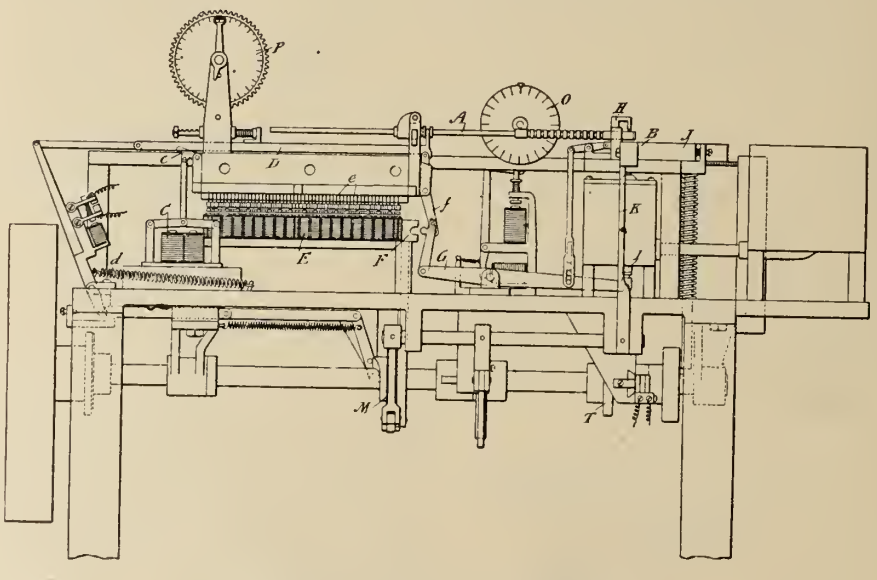


Fig. 2—Plan View of the Complete Machine.

Method of Operation.

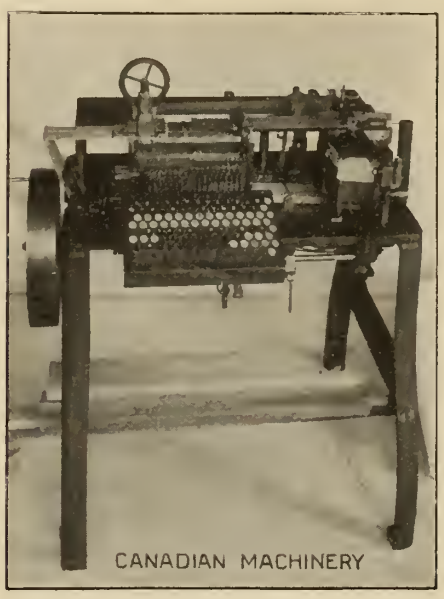
The Pearson invention combines both the casting and composing operations in a single machine and yet it casts single character type. The keyboard operates the casting mechanism directly so that every time a key is struck a corresponding type is immediately cast. This results in a great simplification of the matrix magazine, because the matrices perform their work at once and return to normal position ready to respond to the next touch of the key instead of being held until the entire line has been assembled, justified and cast. On the new machine none of the spaces are formed until all the words of the line are cast and set. But instead of assembling the words in a galley they are kept temporarily in a "word magazine," each word occupying a separate compartment of the magazine. A counter on the machine shows how much the line lacks of being completely filled after the last word has been set, and indicates how thick each space should be to properly justify the line. The key corre-

sponding to the required space is then struck. As the spaces are cast they are successively pushed into the galley with the words in the magazine.

The most interesting feature of the new machine is its multiple font magazine. The matrices are carried on six bars, each bar bearing matrices of a certain unit's thickness. In the machine here illustrated the matrix bars are square in cross section, that is, each bar is formed with four flat faces and on each face a different font of matrices is carried. The number of fonts may be indefinitely increased by increasing the number of faces of the matrix bars. It is probable that the machine will be put on the market with four, six and eight font matrix magazines. At the touch of a lever the matrix bars are all simultaneously turned over to bring a new face into operative position. Thus the setting of advertising matter can go on without interruption no matter how often it may be necessary to change from one font to another.

Details of Machine.

A more intimate knowledge of the machine may be had by referring to Figure 1, which shows a front elevation of the machine with the keyboard removed, and Figure 2, which is a plan view of the complete machine. The matrix bars are shown at (A), and each has its individual mold at (B). The rear bar carries matrices of two units' thickness, and operates over a mold of corresponding width ; the next bar carries three-unit matrices and operates over a three-unit mold, and so on, to the sixth bar, which carries seven-unit matrices. The control of the matrix bars by the keyboard is effected electrically. When a key is depressed it completes the circuit of one of the electromagnets (C), which thereupon withdraws a detent (c) from engagement with a slide bar (D), permitting the latter to be moved forward by a spring (d). The matrix bar which is connected to this slide bar is thereby moved to the mold. One of the magnets (E) is also energized when the key is depressed and it raises a stop pin (c) in the path of a lug on the slide bar, thus stopping the matrix bar with the desired matrix in position over the mold. The casting mechanism belonging to this mold is thrown into engagement with the cam slide (F), by one of the levers (f), which is operated by the forward movement of the slide bar. As soon as the desired matrix reaches the mold, an electrically operated friction clutch couples the cam shaft to the driving pulley. The cam slide (F) then operates to rock the lever (G). A guide clamp (H) and an injector (I) are operated by this lever, the former serving to position the matrix to accurate register with the mold and clamp it firmly in place, while the injector which passes through the pot injects molten metal into the mold. The molds are all formed in a common channel which is partitioned off by means of movable walls attached to a block (J). These walls are withdrawn as soon as the type is cast, and the ejector pushes the type laterally along this channel to a compartment of the "word magazine" (L). The various parts are then returned to their normal positions, the matrix bar being withdrawn by a cam M. The entire operation is performed at a single turn of the cam shaft, which thereupon automatically releases the friction clutch and comes to rest. Thus at each touch of a key the corresponding type is immediately cast. At the end of each word a key is struck which moves the word magazine



New Type Composing Machine.

to bring a new compartment in line with the mold channel, and when all the words of a line are assembled the magazine is returned to its original position with the first word in line with the channel. Thereupon at each touch of the space key the magazine is moved forward to bring the words successively in the path of the ejector (K). By means of a simple device the travel of the injector is increased so that as the spaces are cast they are pushed with the words into the galley (N). Spaces may be cast in any of the molds, and the dials (O) and (P) inform the operator at the end of each line which key to strike and how often to strike it in order to properly justify the line.

To prevent the type from falling over as it is pushed into the galley, it is received in a channel formed between the end block and the fence (R), while a filler piece (S) bears against the end of the line. An adjustable pin (s) on this filler piece springs a latch when the last word is moved into the line, connecting the end block and the fence with their cam (T). This latter lowers the fence and causes the end block to push the assembled line of type down into the galley far enough to permit the assembling of the next line.

It is expected that the new machine will be found very useful in the ad. rooms of our large daily newspapers, and also for composing all classes of matter in the smaller printing offices. It is designed to average about 4,000 ems per hour, though there seems to be no reason why it should not be speeded up to a very much higher figure

EXTENDING THEIR PLANT.

The firm of Sheldon & Sheldon, Galt, Ont., are steadily building up their business to one of large proportions. The efficient manner in which the many large contracts have been carried out by the firm has been the foundation for a steadily increasing business. In consequence, it has been necessary to increase their manufacturing capacity, and plans and specifications are about complete for a large extension to, and the remodeling of, the present plant.

At present, the offices and drafting rooms are in a building separate from the main plant, as is also the foundry. According to the plans for the extension, the offices will be in the corner of the extension, and the present office building removed. The extension is to be a two storey building, 160 x 64 feet, brick and slow-burning timber construction. A temporary wall is to be placed at the end of the new building so as to facilitate further extensions.

The equipment of the plant is to be modern in all detail, including the remodeling of the present plant. This equipment will include traveling electric cranes.

This extension has been contemplated by the firm since the Fall, and during that time plans were made for a new building; but since then new plans have been formed providing for a much larger building than the first.

It is hoped that the new plant will be in running order by March, and at that time a complete description will appear in Canadian Machinery.

"If there were not frequent disappointments, there would be no constant desire and reaching out for better things—no progress, no advancement."

Practical Questions and Answers

Size of Fire Bricks.

Ques.—In what sizes are fire bricks made?

Ans.—There are five regular sizes of brick, besides the different sizes of jamb, wedge, key, arch, skew and circular. The rectangular shapes are: The 9-inch straight, 9x4½x2½ inches; the soap, 9x2½x2½ inches; the checker, 9x3x3 inches; the 2-inch, 9x4½x2 inches; and the split, 9x4½x1¼ inches.

* * *

Punched Plates.

Ques.—When iron and steel plates are punched, there is a certain loss of tenacity owing to the bruising of the metal around the punched hole. What is this loss of tenacity in plates up to ¾-inch?

Ans.—A report made some time ago to Lloyd's Committee contained the following table showing the depreciation in the tenacity of the plate when punched, and when neither reamed nor annealed:

Thickness of plates.	Material of plates.	Loss of tenacity p.c.
¼	steel	8
⅜	steel	18
½	steel	26
⅝	steel	33
¾	iron	18 to 23

In plates less than ¼-inch there was no appreciable loss of tenacity, and it was found that if the plates were reamed out to about ¼-inch greater diameter, the plates were as strong as if the holes had been drilled in the first place. Annealing will restore the plates to their original tenacity.

* * *

Hand vs. Machine Riveting.

Ques.—What advantages has machine riveting over hand riveting as regards efficiency?

Ans.—In a report to the Institute of Mechanical Engineers, made by Professors Unwin and Kennedy, the following points are brought out:

(1) That the shearing resistance of rivets is not greatest in joints riveted by the greatest pressure.

(2) That the ultimate strength of joints is not affected to any appreciable extent by the mode of riveting.

(3) That the most serious defect of hand riveting as compared with machine riveting consists in the fact that in hand-riveting visible slip commences at a comparatively small load, that giving those joints a low value as regards tightness, and possibly also rendering them liable to failure under sudden strains after slip has once commenced.

From tests made by Professors Kennedy and Unwin it was shown that the load at which visible slip started was on an average about twice as great for hydraulic riveting as for hand riveting.

Thus to sum up, the hand riveting is quite as good as hydraulic riveting as regards strength of joint, but for tightness the hydraulic riveting is much superior.

* * *

Thermal Efficiency.

Ques.—What is meant by the thermal efficiency of an engine?

Ans.—The thermal efficiency of an engine, gas or steam, is the limiting efficiency of the engine, and which is never reached because all the heat units that enter the engine in the steam or other gas cannot be converted into useful work because of the loss by radiation, leakage, condensation, etc. The thermal efficiency is expressed by the following formula:

$$E=\frac{T-T'}{T'}, \text{ where}$$

E=thermal efficiency,

T=absolute temperature of the steam or other gas as it enters the engine; and

T′=absolute temperatare of the exhaust steam or gas.

An example will make this plain:

Prob.—To find the thermal efficiency of a steam engine running under a boiler gauge pressure of 150, and exhausting into a condenser, where the vacuum gauge reads 26 inches of mercury.

Sol.—The temperature of steam under a gauge pressure of 150 pounds per square inch is 365 degrees F., and the temperature of steam in a 26-inch vacuum is 127 degrees F.

$$E=\frac{T-T'}{T}=\frac{(365+461)-(127+361)}{365+461}$$

$$=\frac{826-588}{826}=0.28 \text{ nearly}$$

=28 per cent.

* * *

Use of a Booster.

Ques.—What is an electric booster, and for what is it used?

Ans.—A booster is an electric machine inserted in an electric circuit for the purpose of raising the voltage. A booster may be run by motor or otherwise. The machine is used extensively on three-wire lighting systems and street railways, where a constant potential is required. The drop in potential from the generating station to the end of the feeder may be compensated for by a booster. The field and armature of the booster are in series with each other, and with the feeder, and thus the whole current passes through the armature. The E. M. F. of the booster will be proportional to the feeder current, and can be designed so as to increase the line voltage to its original value.

Boosters are also used in central power stations of electric railways to raise the voltage supplied to the feeders connected to the distant sections of the line; and they are used, too, in connection with electric elevator service, where the elevator motors are supplied from the same generator as the lights in the building. The intermittent excessive currents demanded in the elevator service in the starting of the motor produces wide fluctuation of voltage, and a booster is often inserted in the circuit to raise the voltage at the necessary times.

* * *

Hydraulic Forging.

Ques.—Is forging ever done by hydraulic pressure?

Ans.—The hydraulic forging press is often used to produce heavy forgings. When a quick acting steam hammer is used to forge a large mass of metal, the surface of the forged mass tends to absorb nearly all the effect of the blows, whereas when the equally powerful but slower acting hydraulic press is used, there is time for the pressure to be transmitted throughout the metal.

* * *

Efficiency of Centrifugal Fans.

Ques.—On what properties of the centrifugal fan, and on what operating conditions, does the efficiency depend?

Ans.—Very definite experimental results have not been obtained along these lines, but from experiments that have been conducted it would appear that the only two things on which the efficiency of the fan depends appreciably are the shape of the spiral casing and the speed at which the fan is operated. Neither the diameter of the fan nor the width nor the shape of the blades seem to affect the efficiency of the fan.

There are two shapes of spiral cases in use, the first being a large spiral in shape, beginning near the point of cut-off, and the second a circular casing, extending three-quarter way around the circumference of the fan and ending with a short spiral. Fans having the first form of casing nearly always give high efficiency.

The speed giving the highest efficiency seems to be between 5,000 and 6,000 feet per minute. Above 6,000 feet per minute the efficiency drops off rapidly.

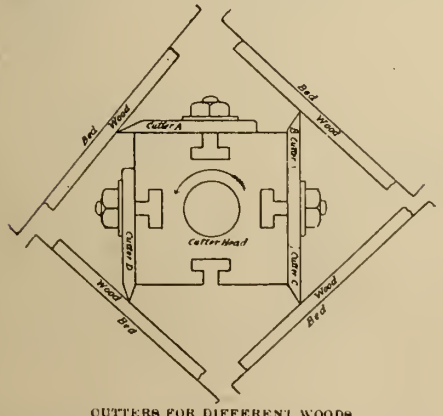
Reviews of the Month

OPINIONS AND STUDIES WORTH NOTING

METHODS FOR CUTTING DIFFERENT WOODS.

THE accompanying sketch almost explains itself, but a few words may make it plainer to some readers. It shows four different methods employed to cut hard and soft woods. (A) is the ordinary cutter found in every factory where wood-cutting is done by machinery, and is about the simplest and best cutter yet devised for all kinds of work. The part below marked "wood" shows the position the cutter has while in the cut. One can readily see the amount of hook or pull this cutter has on the grain, which is very bad in some woods, tearing up the grain in such a manner as to put this cutter out of the question for economical use in good, smooth work in hard or cross-grained wood.

(B) is the same cutter turned on its back and the edge beveled slightly on the face, or that side which now is the back. This is done in order that the edge be stiffened sufficiently so it will not turn over or back as readily as if this were not done. This manner of using cutters is only a makeshift at best, and would never do for heavy work, but it is a very handy way to work when one has only a few pieces to run and it will not pay to make or buy better cutters with which to do the work. Note the position this cutter has in the wood while working. It is almost needless to say that a cutter used this way will not tear up the grain. This cutter takes about twice as much power to do a given piece of work as does the one marked (A). Many milled cutters are used in this manner, to run



CUTTERS FOR DIFFERENT WOODS.

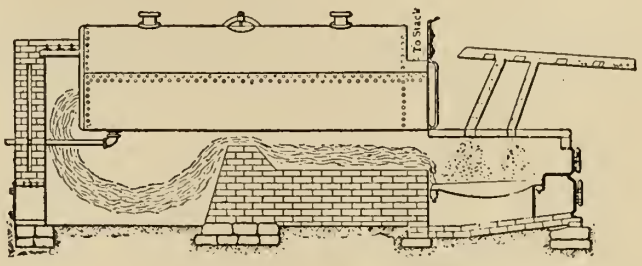
mouldings, the milling being done on that side which is now shown as the back, and the cutter ground straight on the bevel only. By this method the shape of the moulding remains the same always.

(C) is the same cutter as (A) and (B), but used in a different manner. As will be seen, this cutter is set the same as (A), but on the opposite side of the head, thus giving it an entirely different and directly opposite cut when in the wood. This method is only good for a light cut and does very nice finish work where the grain is knotty and there is danger of pulling out otherwise. This method of fastening a cutter may be put to another use—that of a scraping machine. All that is necessary is to sharpen the cutter to a good edge with the whetstone, then take a round instrument and turn the edge inwardly, the same as a bench man would turn the edge of his sand-scraper, except in this case the cutting edge is only turned toward the face to form that hook so necessary in scraping. In scraping the head does not revolve, but is set at the desired angle, fastened in that position and the material fed against the cutter in the same way a man at the bench draws his scraper against the wood, but in this case it is the wood going against the scraper.

(D) is a kind usually used for cross-grained, hard and knotty stock, which is liable to tear out while dressing. Note the way this cutter is ground ; the cutting edge is ground both ways. The effect of this is the edge has very little hook to pull the grain up while in the cut compared with that shown at (A), hence it is better adapted for hard, knotty and cross-grained woods than (A). Its good points over cutters (B) and (C) are that it has a very stiff edge which can be changed to suit the nature of the stock being worked. The reader will readily see that this cutter is well adapted for ordinary use where the work is done in small quantities. The arrow indicates the direction in which the head revolves.—Wood-Worker.

BURNING SAWDUST.

A FURNACE and boiler setting like the one shown in the diagram is an excellent arrangement for burning sawdust. The boiler setting itself is like that usually used in a horizontal boiler, but the grates are in an oven or projection built in front of the boiler instead of being under it. The oven is



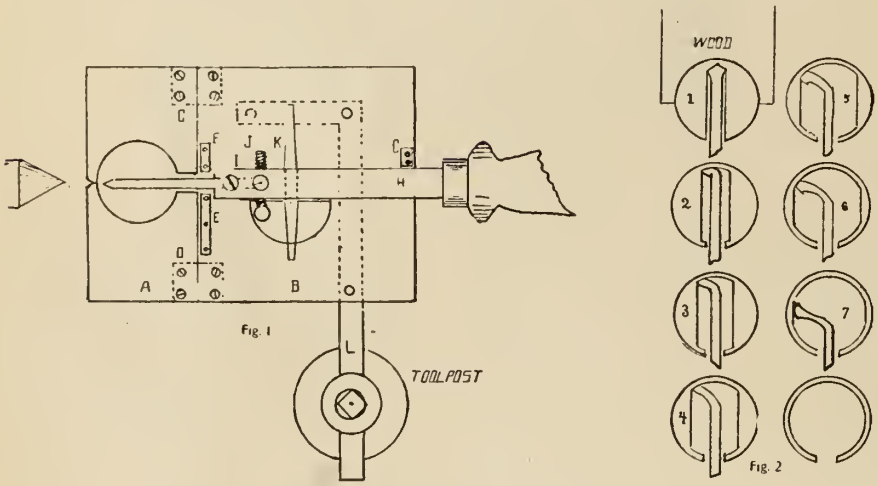
SETTING FOR BURNING SAWDUST.

about 10 feet long and should be full width of the boiler, or if convenient, 2 feet wider than the boiler is preferable. The grates should have $\frac{1}{4}$-inch openings. The sawdust, brought by a mechanical carrier of some kind, is dropped through two chutes onto the grates and lies in two cone-shaped piles that cover the entire grate surface. The fire should be started with shavings or other dry material and will burn principally around the edges where the draft will force itself up through the fuel. When well ignited the surface of the cones will be covered with flames and the sawdust will burn furiously. The supply of sawdust may be regulated by slides in the chutes. It is not necessary to use a firebar ; simply fill up with the fuel and let it burn. To bank the fire at night, fill the furnace well up to the top with the sawdust and level it off, close all doors and the damper and let it alone.—Power.

HOW TO TURN A HOLLOW BALL.

AS most machinists are familiar with the turning of a sphere by means of the compound rest, it will not be necessary to go into details. Assuming we have a ball 1 inch in diameter, and wish to bore out the inside so as to leave a shell 1-16-inch in thickness : A piece of hard wood is clamped in the chuck and the end turned out cup-shaped

(Figure 2, first cut), so that it will extend a trifle over the centre line of the ball. A little chalk rubbed into the wood will help to hold the ball firmly in position. Now the tool rest (Figure 1) is clamped in the tool post by an L-shaped piece of stock (L), riveted to the bottom, just high enough to allow the tool, when resting on the support, to come to the centre of the ball. The tool rest is made of two pieces of sheet metal, (A) and (B), which are hinged together on the line (CD), allowing (A), which is only used as a gauge for setting the tool to be folded down; (E), (F) and (G) are guides for the tool holder, the former two also serving as stops. The tool holder, (H), is made of $\frac{3}{8}$-inch square stock, having a $\frac{1}{8}$-inch hole in the end to insert the tools, which are held by means of a set-screw, (I). Back of this is the guide screw, (J), a piece of 3-16-inch stock is fastened to the end just long enough to reach down into the semi-circular aperture cut into (B). (K) is a crosspiece fastened to the bottom of (H) to insure a wide bearing on the tool



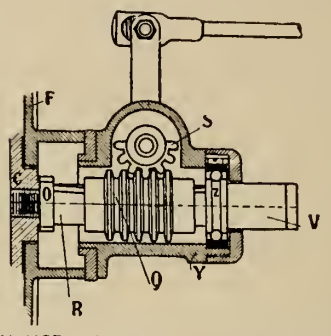
Method of Turning Hollow Ball.

rest. To adjust the tool rest in position we measure the distance between the aperture cut in (A) and the line (C-D), say $\frac{1}{4}$-inch in this case. Now the gauge (A) is folded down and the carriage moved towards the ball until the line (C-D) is $\frac{1}{4}$-inch away from the nearest point of the ball and locked there, then the cross slide is moved to bring the centre line of (H) in line with the lathe centres. If there is any difference between the diameter of the ball and the hole in the gauge plate (A), allowance for such difference must be made in adjusting the tool rest. Now the carriage is backed, the gauge is raised on a level with (B) and the first tool in the shape of a flat drill inserted in the tool holder in such manner that when the tool holder is up against the stops (E-F-G) the point of the drill will be 1-16-inch away from the edge of the hole (Figure 1). Turning the gauge plate down, the carriage is again moved up to the stop and locked there, the ball having been previously centred, we now take the first cut with the tool up to the stop. The chips may be removed by blowing into the hole with a blowpipe. Back up the carriage again and turn up the gauge plate and insert the second tool and turn the guide screw (J) to such position that both cutting edges of the tool will be 1-16-inch away from the edge of the hole in the gauge at either end. Once more the gauge is folded down, the carriage moved up to the stop and we take the second cut. In each of the subsequent cuts another tool must be inserted, shaped to fit that part of the circle to be cut away, and the guide screw (J) must be adjusted to the length of the cut.—Popular Mechanics.

THE MAGNETO IGNITER.

FOR automobiles, motor boats, and gas engine practice generally, the coming of the magneto ignition is apparent, and although its progress has been slow, it has been sure, and during the coming season many makers will give buyers the option of having either magneto or battery ignition, and in some cases both systems will be fitted, the magneto being used for doing the work while running and the batteries for starting up by the switch, the battery adjunct having this advantage, that the operator is able to start up his motor by merely moving over a switch, which saves a lot of cranking, and also dismounting from the car.

Figure 1 gives a view of the advance movement of the Lacoste magneto, while another well known magneto is the Eisemann. As shown in the diagram (Figure 2), the Eisemann igniter consists essentially of a magneto and a transformer. The primary of the latter is constantly connected with the terminals of the former, and a short-circuit interrupter, which also is connected with the terminals, permits at will of sending the current of the magneto into the transformer. When the interrupter is closed, the magneto is in short circuit, and its current attains its maximum degree of intensity and power. If, at this moment,



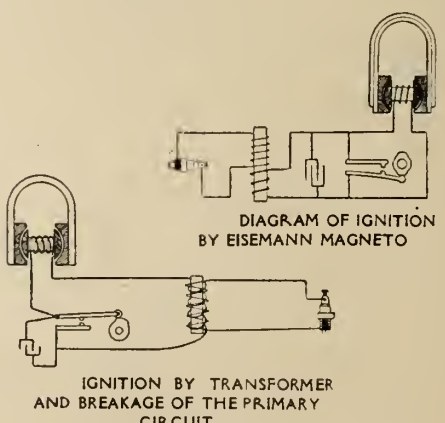
ADVANCE MOVEMENT LACOSTE MAGNETO

F. Supporting Plate. C. Commutator End. O. Timing Gear. Q. Sliding Sleeve. R. Helical Grooves. S. Advance Gear. V. Carter. Y. Driving Shaft. Z. Ball Bearing

Fig. 1.

the interrupter be opened, it will be possible for the current to circulate only through the primary of the transformer. The result of this is that when the current reaches the transformer, a supermagnetization of the iron core is produced, greater than that which would correspond to the current normally developed by the magneto unprovided with this arrangement.

Referring to the diagrams of high-tension ignition apparatus, we find that both break the primary current in order to produce in the coil the variation of magnetic flaw which gives rise in the secondary to the high tension that is utilized. But when a current is broken by separating the two contacts of the breaker a spark is produced between them. The wear resulting from this spark is abolished by the use of a condenser. Here are shown two other methods by which ignition is obtained



IGNITION BY TRANSFORMER AND BREAKAGE OF THE PRIMARY CIRCUIT

Fig. 2.

with a magneto. In the diagram of Figure 4, the upper left-hand view shows the spirals of the winding being traversed by the magnetic flow emanating

from the magneto, while the view to the right shows the flow a minimum. It may be seen that the flow will change direction twice per revolution. The laws of induction teach us that there will, consequently, be produced in the armature a variable periodical electromotive force presenting a maximum at every half revolution. If we close the exterior there will correspond a maximum of currents to every maximum of electromotive force. We shall, therefore, be able to obtain two sparks per revolution of the magneto. This condition determines the rotary velocity of the magneto with respect to the motor. If the motor is a four-cylinder one, such velocity will be that of the motor, since four sparks are necessary at every two revolutions of its shaft. If it is a two-cylinder one, a control, reducing the velocity one-half, may suffice. Finally, if the motor has three cylinders, it will require three sparks at every two revolutions. It will suffice for the motor to make one revolution and a half at every two revolutions of the mator. The current-breaker placed upon the magneto and controlled by a cam causes an abrupt emission of the current of the magneto into the primary of the transformer. This impulsion of current gives rise to a high-tension current in the secondary, and this is automatically sent to each of the spark plugs by a distributor connected mechanically with the magneto in order to operate synchronously with it.

The inductor of the magneto shown in the lower view is formed of three pairs of horseshoe magnets, placed side by side. These magnets are secured by screws to cast-iron polar pieces, the object of which is to distribute the magnetic flow uniformly upon the armature.

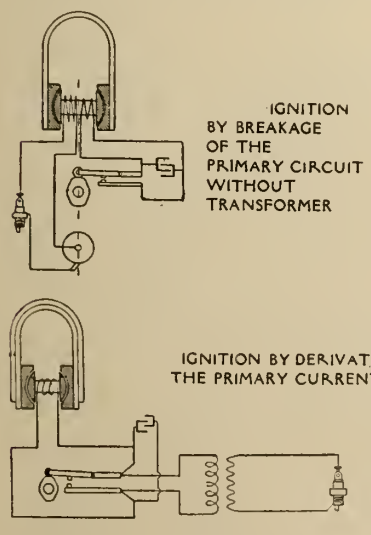


Fig. 3.

The nature of the steel and the temper to which the magnet is submitted after manufacture are the sole guarantees of the duration of the magnets. They assure them a greater resistance to the external causes that may bring about their demagnetization, such as heat, vibration, shocks and the very near vicinity of powerful electromagnets or alternators.

STATIC ELECTRICITY IN ORE SEPARATION.

FOR nearly five years electrostatic ore separators have been in successful use. This is true, at least, of the Blake-Morscher machine, of which more than forty are in operation. When this machine was first introduced commercially, its use was largely confined to those ores whose constituent particles differed widely from each other in conductivity.

Another process developed by this company, and one not widely known, is that which depends for its operation on the specific inductivity of various materials. In its simplest form, shown in the annexed illustration, the apparatus now in use consists of a hopper and feeding device (A), charged poles (B) and (B1), and receptacles (C), (C1), (C2) and (C3).

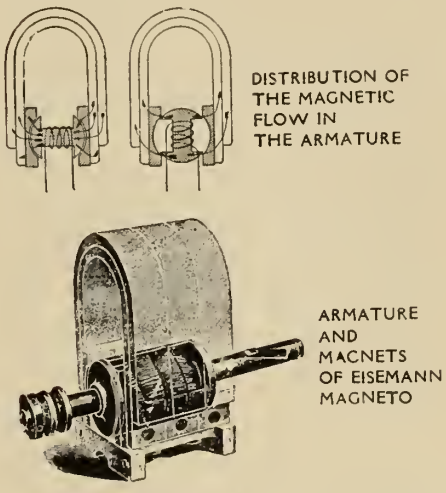


Fig. 4.

The poles (B) and (B1) are usually highly charged with electricity of opposite sign, but not necessarily of the same potential. When a stream of ore particles is dropped through the field between the two poles, the particles are urged out of their original path and into different directions, with varying degrees of force, depending on differences in their specific inductivity ; the several minerals fall, each into its own receptacle at the bottom. Nothing could be much simpler, yet the thing is positive, and the results are remarkable.

With such an apparatus it is possible to separate substances independently of their conductivity. As an example of materials of approximately equal conductivity fluorite may be separated from quartz or barite, barite from blende, and feldspar from corundum.

It must be evident that this enormously widens the field of the electrostatic process ; and, when used in connection with conductivity separations (where the conductivity is either natural or produced artificially), it gives a range covering almost all known minerals.

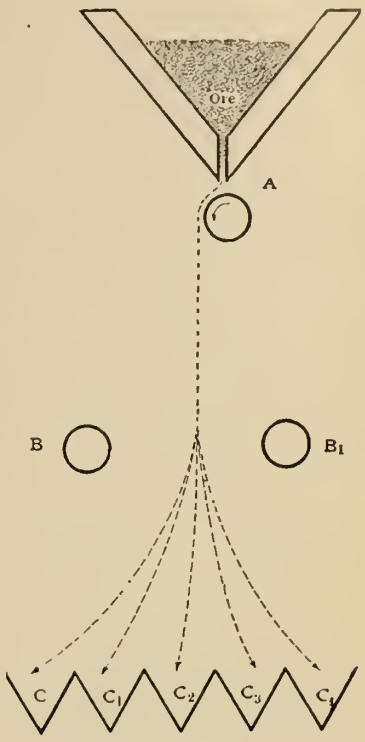


Diagram of Apparatus for Ore Separation.

The electrostatic generator has also been made closely to approximate the dynamo in reliability. The machine of the laboratory or of the physician, running uncertainly a few moments at a time, has given place to mechanically strong and powerful mica-plate generators, running continuously night and day, in damp and dusty mills, with ordinary help.

As now used by the Blake Company, all brushes and other moving contacts are abandoned ; the field-plates are in static shunt with the generating rotors, so that the machines are self-exciting. The ozone and nitrogen compounds which are continuously formed are removed as fast as generated, by a forced draft of hot, dry air, which also prevents all moisture deposits, so that the machines are now independent of atmosphere or altitude.—Engineering and Mining Journal.

CONCENTRATION.

" When you set out to do anything, never let anything disturb you from doing that one thing. This power of putting the thought on one particular thing, and keeping it there for hours at a time, takes practice, and it takes a long time to get into the habit "—Thomas A. Edison.

BOOK REVIEWS

Choosing a Career, by Orison Swett Marden, an outline of the possibilities in life. 481 pages. Indianapolis: The Bobbs-Merrill Co., publishers.

No one can peruse the pages of this book without catching, somewhat, the enthusiasm and inspiration of the author in his logical outline of the different considerations to be taken into account when choosing a career. Throughout, the thought is kept prominent that one should engage in a vocation at which he will be happy, the latter being paramount, compared with which the acquisition of wealth is nothing. The keynote of this is expressed in the author's words "Other things being equal, try to enter a calling which will have an uplifting influence upon your health, which will be a perpetual tonic to you, not a depressant." Without health one cannot achieve success.

The author states that it is a mistake to think that everyone has a decided bent for a particular vocation, as many people are so finely balanced in their mental make-up that they can follow one of several callings with equal facility.

Not only should this book be read by every young man and woman, but by every parent anxious for the welfare of his or her offspring. It is a gem sparkling with sage advice and up-lifting suggestion, and is, at the same time, interesting and fascinating. It broadens one's vision of life, inspires to better effort and offers practical assistance to those in doubt as to the future. To every reader of Canadian Machinery, "Choosing a Career" is heartily recommended.

Machine Tools and Workshop Practice, by Alfred Parr, instructor in fitting and machine shop and forge, University College, Nottingham. A practical work for engineering students and apprentices, 444 pages, 510 illustrations. Price, 10s. 6d net. London: Longmans Green & Co., 39 Paternoster Row.

At the outset the author announces that this volume is the result of an increasing demand for technical instruction by engineering students and apprentices, and with this in view the subject matter has been prepared. For either the student or the skilled mechanic, this volume is exceedingly valuable, covering, as it does, the entire range of machine shop practice, a commendable feature being the numerous drawings that assist the descriptive matter to no small extent. The opening chapter on "measurement" gives the reader an idea of the wonderful precision attained in present day mechanical practice. Following a chapter on "Marking or Laying out Tools," is one devoted to the metals used and their properties. The different machine tools are then described and the modern practice associated with each explained. The chapter on cutting tools is one of the most valuable. Going somewhat out of the machine shop, forge shop tools and hydraulic machine tools are dealt with, when the subject of transmission of power is gone into in some detail. The last chapter is devoted to methods of working.

This volume is meritorious from a mechanical and technical standpoint and will prove of considerable value to the class for whom it is designed. In a subsequent edition it might be suggested that the quality of the illustrations be improved, as many of them are below standard.

Manual of Mechanical Drawing, by Phillip D. Johnston, superintendent and mechanical engineer, West Point Foundry. A simple and thorough groundwork in modern drafting room practice; covered. New York: David Williams Co., publishers . Bound in cloth. Size, 7 1-2 by 9 1-2 inches. Price, $2.00.

A good many books on mechanical drawing have been issued from time to time, each with its strong points and its weaknesses, but the book on mechanical drawing under review has approached a standard of excellence against which little criticism can be made, and in favor of which there is every chance of appearing partial. It covers thoroughly the ground work intended for those studying or practicing mechanical drawing, and serves as a means of self instruction for working mechanics, apprentices and students generally. The book is concise and at the same time broad in its scope. The study of this on the part of a student would give him a thorough insight into modern drafting room practice.

The Practical Engineer's Pocket Book and Diary for 1906. Manchester Technical Publishing Co. Price, 1s. 6d.

This is a companion to the Electrical Pocket Book published by the same firm. It is, however, much more detailed than the other, containing nearly 600 pages and takes up the subject from the viewpoint of the mechanical engineer, being primarily arranged for his benefit. However, it has a claim on every metal working mechanic as well as those associated with the generation of power.

Modern Machine Shop Construction, by Oscar E. Perrigo, M.E. Nearly 400 large quarto pages; over 200 engravings; price $5. Dealing with the equipment and management, as well as the construction, of the modern machine shop. New York: Norman W. Henley Publishing Co., 132 Nassau street.

This book has been designed for the practical and everyday use of the architect who designs, the manufacturer who builds, the engineers who plan and equip, the superintendents who organize and direct, and for the information of every stockholder, director, officer, accountant, clerk, superintendent, foreman and workman of the modern machine shop and manufacturing plant.

Modern machine shop construction has entered the field just at a time when such a volume was most needed, and the excellent manner in which the author deals with the subject speaks well for his intimate knowledge of everything connected with the machine shop and manufacturing plant. It fills a place for those contemplating building, as well as for manufacturers already long established. It is divided into three parts, the first of which deals with the construction from the choosing of the site to the complete equipment of the plant. Different methods of building are dealt with, followed by the matter of a power house, heating ventilating and lighting systems, as well as other adjuncts of an up-to-date plant. In the second part the equipment is discussed, the buildings and apartments being first arranged and allocated. Each of these receives attention, and the machinery necessary to equip it thoroughly is mentioned. An important feature here is the transportation problem, which is fully discussed. The management is taken up in part three, divided into capitalization, manufacturing and selling. This feature of the book is one that receives too little attention at the hands of manufacturers, and yet is one of the most important considerations that go towards making manufacturing a success or a failure. The important subject of cost keeping is treated in a most systematic manner, different methods and their operations being fully developed.

The volume under review should find its way into every manufacturing plant and industrial concern aiming to keep abreast of the times.

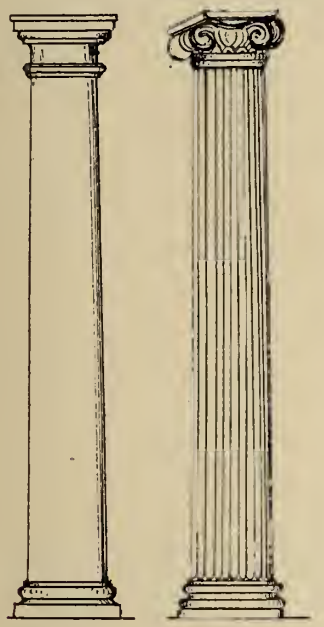
Construction and Improvement

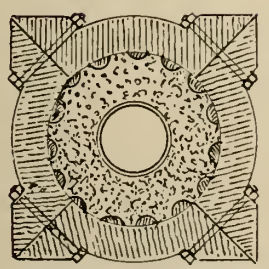
General Construction *Contractors' Supplies*

THE CONCRETE COLUMN COMING.

OUR factory buildings and manufacturing plants are not intended to be things of beauty or ornaments to the neighborhood, being designed, as they well should, with an eye to economy. At the same time a little more thought and attention as to appearance would go a long way towards making

Columns made of Concrete — Caps & Bases of Cement





— Sectional view of mould — for fluted Shafts —

attractive and more desirable the district in which they are located. There is no reason why the fronts of industrial concerns should not be designed with the same artistic effect as those of banks and public buildings, now that the adaptations of cement and concrete are so manifold, and the cost compared with stone so low.

One of the means to this end should be found in the concrete column now being made to considerable extent. According to Cement and Engineering News, from which the views shown of molding concrete columns are taken, the concrete column must and will eventually displace those of stone and wood. A wooden column fluted, 20 feet high by 30 inches in diameter, will cost at the factory $85.00, with transportation charges extra. The form for molding such a column in concrete will cost $100. Assuming only four columns made from this form, the cost comes to $25 each. From actual experience four columns were made from a form at a total cost of $50 each, a saving of $35 a column over wood, or $140 on the four. Six other columns were subsequently erected of concrete on the river front of the same building, using the same form. This reduced the price of the form to $10 per column, while the concrete and labor of placing into the form was $25 per column, or $350 for the ten concrete columns complete, as against $850 for wooden columns, showing a net saving of $500 on the ten columns in favor of concrete.

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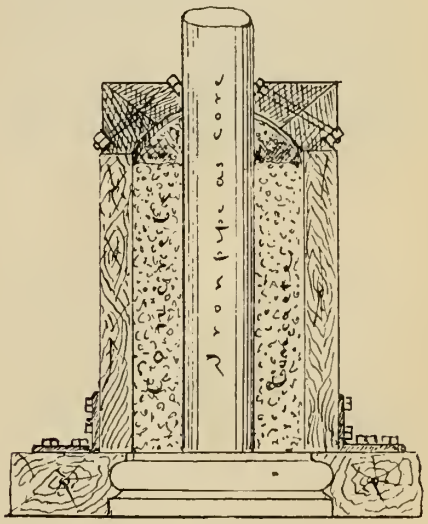
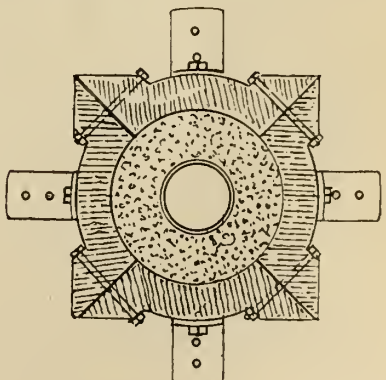
LIGHTNING AND MODERN STRUCTURES.

IT is a well known fact that any constructions made entirely of iron are practically immune against the effects of lightning, as the amount of electricity accumulated in the case of a lightning stroke is allowed to distribute itself over the large surface of the roof, and to flow off to the earth at many places with greatly reduced intensity. Conditions are quite similar in connection with buildings made entirely of armored concrete, as the discharging current will find the roofing iron and distribution rods of an armored concrete roof, struck by lightning, a good conductor of electricity, so as to flow off to the more substantial girder iron with which the roofing iron is connected by wire meshes. Now, as experience has shown lightning not to be discharged to the earth in a concentrated jet from the place of striking, but to have a tendency to distribute itself to all sides, if possible, the electricity will be diffused throughout the roof traversed by a network of iron rods. The electricity being greatly reduced in intensity, will have an excellent opportunity of flowing off to the ground through the round irons inserted in armored concrete columns, thus being communicated to the foundations of the current column, which in turn transmits it to the ground. This shows that neither artificial lightning arresters nor their parts will be required in connection with any construction consisting entirely of armored concrete.

Part of Sectional view of Mould for forming Shafts





— Sectional Plan of mould — for Shaft

Steel Smoke Stacks for Mills

By F. C. Douglas Wilkes, B.Sc.

IN the place of brick stacks for saw mills and similar plants that are isolated, steel stacks are almost invariably used. They are much cheaper than brick and more easily erected, and last the life of the mill, if properly erected in the first instance, equally as well as a brick chimney. Of course a chimney of brick will outlast one of steel as the elements do not make such

I.—Stack Being Erected.

inroads upon brick as upon steel, but this long life is of no material advantage when the cost of each is compared, because the situation of the mill itself is liable to be changed and moved nearer to the timber limits long before the brick stack is beginning to show any signs of dilapidation.

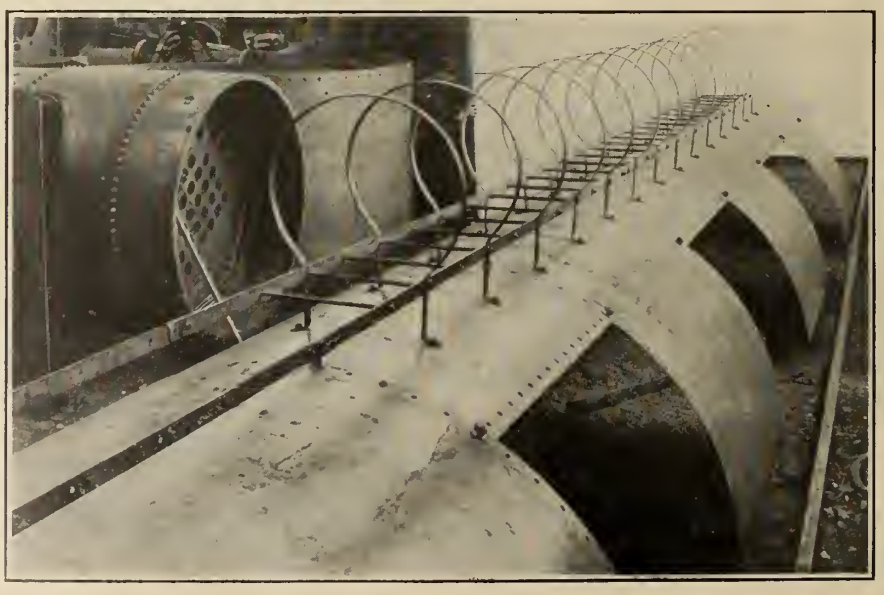
Steel stacks are manufactured and shipped to the mill site in two ways. One way is to make the stack up into lengths, like the lengths of a huge stove pipe, and these are forwarded in this shape to be erected. The pieces are riveted together into one length while on the ground near the spot where it is to be put up. A stout mast is manufactured by splicing lengths of timber together, if one piece of suitable length is not obtainable, and this is set up as close to the stack base as possible. The length of the mast is dependent on the length of the stack to be erected and should be as long as half the stack plus the height of brickwork, plus six or seven feet to clear the tackle when stack has been hoisted high enough to drop into place, plus one foot for the guys above the tackle. The guys should be made of rope that has been used so that most of the "stretch" is out of it, and then when the mast is guyed it is not likely to sag one way or the other when the weight of the stack comes on it. The stack is slung just on one side of its centre by an endless chain sling which is just long enough to go round the stack and permit the hook of the hoisting cable to be hung to it. The position of the sling should be against the first row of rivets off the centre. A guide rope is fastened to the end of the stack to be near the ground and it is then ready to be hoisted into place. Any suitable means of hoisting may be used providing it is of sufficient strength to do the work. Photo No. 1 shows a stack being erected in this manner. This method is used whenever the size of the stack makes it practicable, but in the erection of very large steel stacks say of 100 feet in length and six feet in diameter this method would hardly do on account of the immense weight and the unwieldiness of a stack of this size.

Then the plates are sized and punched at the manufacturer's and tried as for fit, etc., before being sent out. Photo No. 2 shows a portion of a stack six feet in diameter and one hundred feet in length, as it is being tried in the shop. In this stack there are three plates to a "course." The bottom plates are $\frac{1}{4}$ or $\frac{3}{8}$ of an inch thick, the midway plates are 3-16 or $\frac{1}{4}$-inch thick and the top plates are $\frac{1}{8}$ or 3-16-inch thick. The ladder is provided with guard rings, and is also built in sections.

Materials of Construction.

When the sections are all marked and at the mill site, the materials used and the procedure of erection are as follows: Materials used—One crane, suitable length of cable, one winch or hoisting engine, one piece of hard wood to support crane, sufficient planking for platforms and sufficient material for scaffolding to the length of the stack, and if the rivets are driven hot a small portable forge is required. The crane as shown in Figure 1 consists of a piece of hard wood 4 by 4 inches, about 15 feet long. Across the top of this is a shorter piece of the same stuff 3 feet 3 inches long, making the arm of the crane, which carries the sheave wheels. The centre of one wheel is about 20 feet from the centre of the mast and the centre of the other is about $7\frac{1}{2}$ inches from centre of mast. The arm is fastened to the mast by being tenoned through it and bolted. It is supported on its longer end by a piece of bar iron $\frac{5}{8}$ by 2 inches. The crane arm is morticed to receive the sheave wheels which run on bolts of suitable strength used as axles. Bolts $\frac{3}{4}$ inch in diameter are strong enough. Two wooden blocks are placed at the end of the arm for the purpose of keeping the cable always on the sheave wheels. The crane has its foundation on a piece of hard wood 3 by 12 inches on the second stage of the scaffolding and is turned where it passes through the platform above.

The cable is of flexible steel wire $\frac{3}{8}$ inch diameter. This should be long enough to reach from the ground to ten or fifteen feet above the highest part of the stack when erected and thence to the bottom of the stack and to the winch. It is supplied on the end with an eye to which are fastened two pieces of $\frac{3}{8}$ chain. Each piece of chain is about 3 feet long and is supplied at the free end with a clevice of about 5-inch centres which is provided with a $\frac{5}{8}$ bolt



II.—Portion of Stack, 6Feet Diameter, 100 Feet Long.

to fasten to the sheet being hoisted. If $\frac{5}{8}$ rivets are being used this bolt should be a $\frac{1}{2}$-inch bolt so as to go in and out of the rivet holes easily.

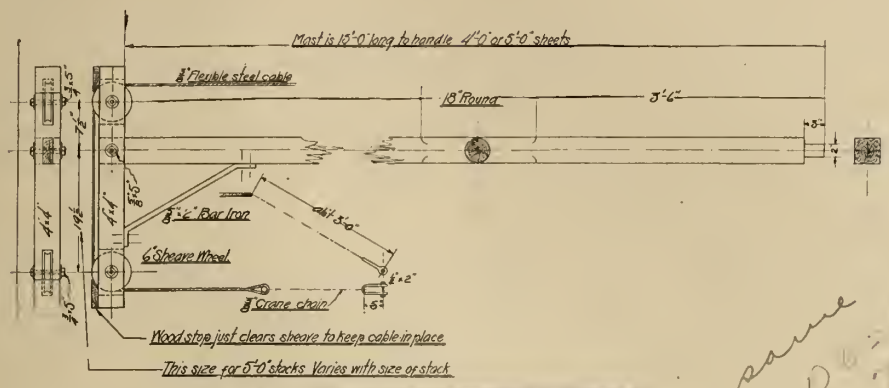

Mast is 13'-0" long to handle 4'-0" or 5'-0" sheets
Flexible steel cable
13' Round
Bar Iron
Sheave Wheel
Crane chain
Wood stop just clears sheave to keep cable in place
This size for 5'-0" stacks Varies with size of stack

Fig. 1—Detail of Crane for Erecting Steel Stacks.

The suspension cage shown in detail in Figure 2 is substantially constructed of pine, the two uprights and support for flooring being of $3\frac{1}{2}$ by $3\frac{1}{2}$ stuff. The flooring is composed of 2-inch planks and the railing of $1\frac{3}{4}$ by $2\frac{3}{4}$ stuff. The supports for the flooring are tenoned through the uprights and fastened with bolts. There are also two tension supports of $\frac{3}{4}$-inch round iron which are bolted through the floor to the floor supports. At the top of the uprights are two grooved wheels which are hung by bar iron supports twisted in such a manner that the wheels will run on the circumference of the stack. At the bottom these uprights have fastened to them two small crown faced wheels which prevent the cage from coming into contact with the stack.

The winch may be of any convenient size or description to suit the erector so long as it is powerful enough to lift the heaviest sheet. It is placed preferably in line with the soot door through which the cable comes from the crane.

The forge should not be too large as it is used inside the stack on the same platform where there are two men wielding their rivetting hammers, consequently there is but little room to spare.

Method of Erection.

The manner of erection is as follows: It is supposed in the following that the brick foundation of the stack has already been completed and is now ready for the cast iron stack base which is fastened to the brickwork by heavy anchor bolts of suitable length and strength. The scaffolding is built up inside the brickwork to within about twelve inches of the top and then the platform is laid loose upon it. The platform (see Figure III) is made of 2 by 4-inch stuff, there being six uprights with two 2 by 4-inch pieces laid flat across the top. The two outside couples of uprights are connected by two pieces also 2 by 4-inch. These pieces should be about 10 inches from the circumference of the stack at their centres and extend on either side to the circumference. About 3 feet 5 or 6 inches below the platform the support for the crane is laid across two tie pieces placed on the uprights for this purpose. The crane mast is stepped through the platform with its heel through this support. The cable runs through the platform, passing over a sheave wheel placed opposite the soot door and thence through the door to the winch.

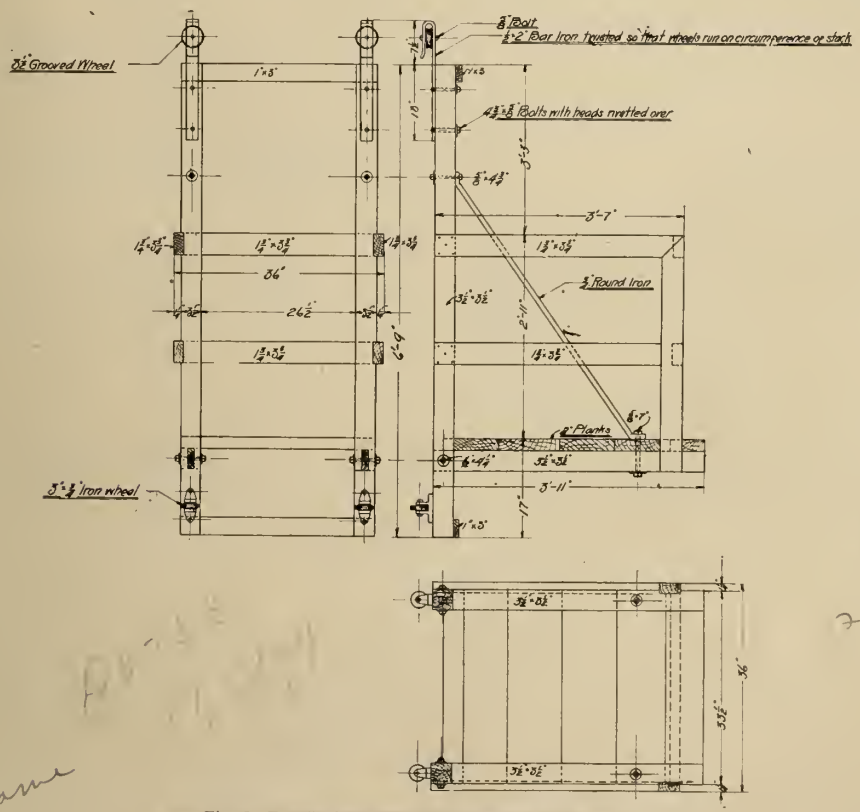


Fig. 2—Detail of Cage Used in Erection of Steel Stacks

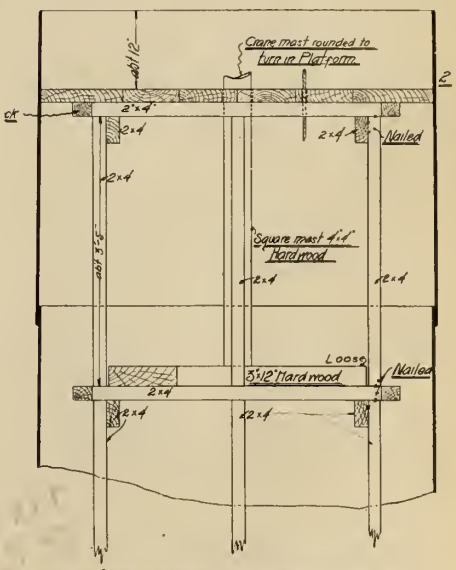


Fig. 3 Scaffolding Used in Erecting Steel Stacks.

(Concluded in next issue)

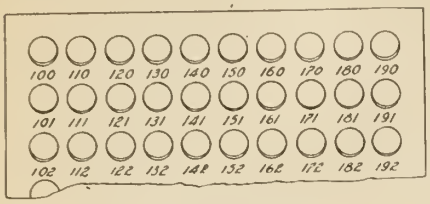
Machine Shop Costs

By G. C. Keith.

THE TIMEKEEPER.

(*Continued from January.*)

IN the time office the first duty of the timekeeper is to note and register the time each workman enters and leaves the shop. In many Canadian shops the opening hour is seven o'clock



FORM OF BOARD

Fig. 1.

and the closing hour six o'clock, making ten hours a day's work. A very good and simple system of registering the working time of an employe is the check system. Many clock systems have been devised, but in these a mistake is much more easily made than in either of the following systems. Where the shop is divided up and there are several exits the cabinet may be employed to advantage. Each employe is given a check bearing a number, which number is used for his name during his stay with the firm. A man enters in the morning, takes his check from the hook on a board under which is a number corresponding to the number on the check, and drops it in a box beneath the cabinet. In this cabinet are also hooks with numbers corresponding to the checks. When the whistle blows at seven or one o'clock the timekeeper removes the checks still remaining on the board and hangs the checks in the box on the hooks in the cabinet and he keeps track of the absent ones. The door of the cabinet is then closed. In this age of electricity it is an easy matter to arrange a catch so that when the timekeeper touches a button in his office the

Fig. 2.

latch is lifted and the door thrown open by spring hinges. At twelve and six o'clock the workmen remove their checks from the cabinet and hang them on the board. They are then ready for the workmen when they return at one or seven o'clock. The cabinet is then closed so that the men have access to it only when the whistle blows at twelve or six o'clock. Cabinets for this purpose can be bought from manufacturers who make a specialty of cost supplies.

Another efficient method and one which may be employed in the smallest shops is the check system with the use of the boards only. Boards one inch in thickness and two feet long by eighteen inches wide are prepared in the following manner: Holes of $1\frac{1}{2}$-inch diameter are bored to the depth of $\frac{1}{8}$-inch. Leave about $\frac{1}{4}$-inch between the holes at the side and $\frac{3}{4}$-inch between the top of and the bottom of the next. At the bottom of the hole a slight cutting is taken out by means of a chisel. This allows the

SHOP STATEMENT..... Mar 1st 19 06.

CHECK No	HOURS WORKED	RATE	TOTAL		CHECK No	HOURS WORKED	RATE	TOTAL	
100	10	22½	2	25	150	10	12½	1	25
101	—	—			151	9½	12	1	14
102	10	21½	2	15	152	10	16	1	60
103	9½	20	1	95	153	10	15	1	50
104	5	20	1	00	154	—	—		

Fig. 3.

Mar. 1st/05.

ABSENT		LATE		ABSENT		LATE	
AM	PM.	AM	PM	AM	PM.	AM.	PM.
101	101	103-7.15	151-1.13				
104		151 7.13					

Fig. 4.

check to be easily removed. Numbers are printed beneath the holes and the checks, made a little smaller than the holes and of brass bearing corresponding numbers, are inserted in the holes above their numbers. These check boards when not in use may be arranged in a cabinet. Before starting time the timekeeper arranges them on a long table in front of his wicket. If it is a small shop an ordinary table will serve the purpose. As the workmen enter in the morning or at noon each man is given a number which is his during his stay with the firm. When the man goes out again at twelve or six he drops his check into a box prepared for the purpose. This box has a hole in the top just large enough to admit one check. This system has one disadvantage. The workmen carry around their checks all day and are liable to lose them. Before twelve and six o'clock the board is "called off" by the timekeeper's assistant and the numbers of the men absent are noted. If a workman leaves before twelve or six he must produce an order from the foreman. The timekeeper then takes the check and marks down the hour of his departure. The following day a form is filled out with the num-

DATE Mar. 1st/05.

MR. TIME-KEEPER,— PASS OUT

MR. J. Eldora.....

CHECK No. 110. FOREMAN. JHC.

Fig. 5.

ber of hours and the rate of each man. A copy of these number of hours is made in the semi-monthly payroll.

A book may be used for the absent and late.

A foreman's order to permit a workman to leave before twelve or six must be signed by him and a column in the absent and late book may be added and the hour of leaving the works is marked in it.

Each day the piece-workers or pre-

ENGINE MANFG CO. LIMITED

TIME CARD

MANS No. MACHINE No. ORDER No.

DISCRIPTION OF WORK.

PATTERN No.

TIME BROT FROM PREVIOUS CARD —MONTH—		HOURS	BROT UP		HOURS
	1			17	
	2			18	
	3			19	
	4			20	
	5			21	
	6			22	
	7			23	
	8			24	
	9			25	
	10			26	
	11			27	
	12			28	
	13			29	
	14			30	
	15			31	
	16		TIME CARRIED TO NEXT JOB		
CARRIED UP			TOTAL TIME ON JOB		

JOB COMPLETE

..... FOREMAN.

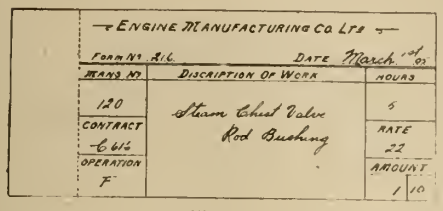
—NOTE INSTRUCTIONS ON BACK—

Fig. 6.

mium men hand in a statement of their work to the timekeeper. A form such as the one shown in No. 4 of Canadian Machinery may be used.

Another form that may be used and will explain itself is the following :

The following instructions are printed on the back :


ENGINE MANUFACTURING Co Ltd

FORM No. A16. DATE March 1st 05

MANS. No	DISCRIPTION OF WORK	HOURS
120	Steam Chest Valve Rod Bushing	5
CONTRACT 612		RATE 22
OPERATION F		AMOUNT 1 10

Fig. 7.

"This card is to be signed by the foreman on completion of job.

"Operator to give completed card to timekeeper.

"On starting a new job foreman will fill out a new card containing a description with pattern number for the operator.

"Timekeeper on his daily round will record on this card the time spent each day.

"A separate card to be used for each job."

It entails very little additional outlay in obtaining an account of the work done by the other men in the machine shop. This should be obtained before closing time. If a man goes out early have him give an account of his work and for the others the timekeeper can go around the machine shop and obtain from each man a list of his work for the day. Supposing our machine shop to be building engines. Then for each operation and contract a leaf like the following would be filled out :

DAILY DISTRIBUTION OF WORK

612		613		614		615		616	
1	15	1	14		67	2	25		
1	16		67		68	2	25		
1	10	1	10	1	10	2	00		
1	10	2	10	2	00	2	25		

Fig. 8.

The total amounts on each slip are added together and correspond with the total amount of the shop statement. These are then sent to the office of the cost clerk, who uses them to obtain the detailed cost of the engines. One entry is made on each slip, which is about 3x6 inches or any convenient size. The timekeeper must write out the operations of the premium worker on these slips also before attempting to make a balance. In the place for operation, (F) is put for fitting, (Pl) for planing, (D) for drilling, (T) for turning, etc.

Before sending these to the cost department it is the duty of the timekeeper to make out a form showing the daily distribution of work.

The cost of repairing, watching, etc., is charged to M.S. (machine shop), and is added to the cost of the contracts in proportion to the other labor costs.

This is also sent to the cost clerk for reference and it may be arranged afterwards showing the totals.

LABOR SUMMARY

DATE Mar 1/05

	NET	CHG %	TOTAL
Contract 612			
" 613			
" 614			
" 616			
"			
"			
Repair order A108			
" " A109			
" "			
" "			
Stock			
Staff Salaries			

Fig. 9.

The per cent. charge is calculated on the productive labor and covers taxes and other expenses. It is an average per cent. taken for a number of years. This per cent. is also added in obtaining the true cost of a machine.

The timekeeper each fortnight or semi-monthly or monthly, according as the men are paid, fills out a payroll which is sent up to the cashier's office.

This payroll is for use where a premium system is in use. For a piece-work system a little different arrangement would be necessary. The day-work hours would go in the column for hours. Where the column "total hours" is there would be two columns, "hours piece-work" and "total hours," and under "premium" would be "piece-work."

ENGINE COMPANY LIMITED

PAY ROLL (DAYS) HALF MONTHLY ENDING Feb 15/05

CHECK No	NAME	OCCUPATION																TOTAL HOURS	RATE	PREM	STOCK No	TOTAL	CHECK No
100																							100
101				(Hours)														(Hours)					101
102																							102

Fig. 10.

PERSONAL MENTION.

Mr. W. T. Standish, manufacturers' agent, of Toronto, has become special representative of Brown-Boggs Company, Limited, Hamilton, Ont., with a view to further extending the sale of the numerous lines manufactured by this firm.

Mr. T. T. Simpson, civil engineer, Ottawa, has been appointed engineer for the town of Parry Sound. Plans are now being prepared for a new electric and hydraulic plant, and contracts for the water wheels will be closed in a few weeks.

Mr. G. F. Spry, for six years foreman of the boiler department of the Polson Iron Works, has gone to Collingwood to a similar position with the Collingwood Shipbuilding Company. Before leaving he was presented with a traveling case and a gold headed umbrella by the men in his department.

Mr. R. J. Young who has been a conspicuous figure in the life of the Canadian Manufacturers' Association during the past four years, as secretary of the organization, has resigned to accept another position. Mr. Young is now salesmanager of the Canadian Rubber Co., of Montreal, in which position he will doubtless meet with unqualified success.

Mr. R. O. McCulloch, of Goldie & McCulloch Co., Galt, met with an unfortunate accident while driving near his home town. The horse shied, overturning the vehicle and throwing Mr. McCulloch to the ground breaking his right arm at the elbow and shaking him up generally. Mr. McCulloch's friends will be glad to know that he is recovering rapidly.

A prominent Canadian in the person of Mr. Chas. F. Gildersleeve passed away at his home in Kingston, on Jan. 18. Mr. Gildersleeve was of the sixth generation of that name to engage in the shipbuilding and steamboat business, being prominently known as manager of the R. & O. Navigation Co. He was founder and first president of the Canadian Marine Association. He was a public spirited citizen, and took an active interest in the country's welfare.

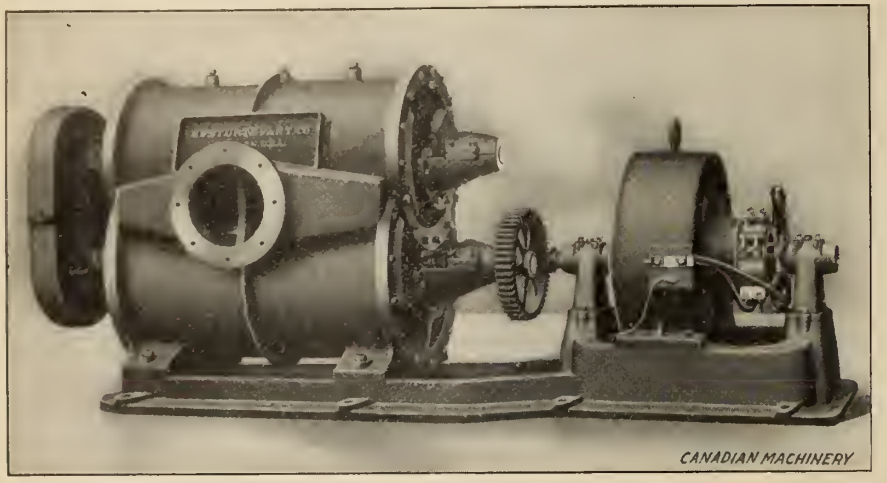
Mr. Genzo Kobayashi, representing the Japanese Government, is in Canada this month studying the systems adopted by the Canadian Pacific and Grand Trunk Railways. He thinks the Manchurian Railway can be run much along the same lines as the Canadian roads. Mr. Kobayashi is a typical Japanese, is well read, and has traveled extensively. He has studied the railroads of other countries as well, with a view to reporting as to the best plan to adopt in his native country.

Power and Transmission

Steam Gas Electricity Compressed Air Water

CONSTRUCTION OF NEW HIGH PRESSURE BLOWER.

HIGH pressure blowers are now made by B. F. Sturtevant in two types ; in the horizontal, the two shafts lie in a horizontal plane, while in the vertical one shaft is above the other. The blower consists of a cast-iron shell or housing in which are two rotating members or "rotors." One of these, the impeller, revolves in the larger portion of the casing which in the vertical type is the lower. It does the real work of compression. The other rotor, known as the idler, does no work ; it successively provides spaces or chambers of proper shape at the desired points in the revolution.



General View of Sturtevant Blower, Motor Connected.

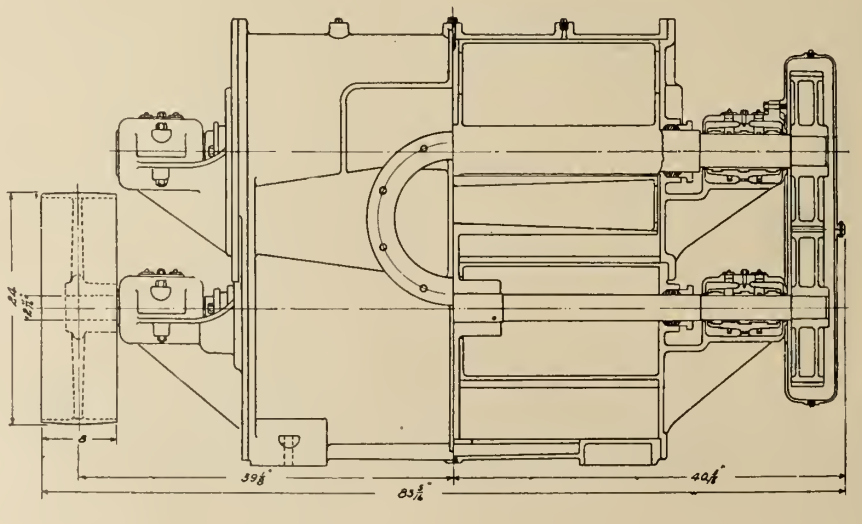
Ample clearance between the rotating members and the casing insures high mechanical efficiency by absolutely preventing internal friction due to contact of metal surfaces. Between the idler and the impeller the space is so great that only excessive variation in the accurate running of the gears will allow the two rotors to come in contact. This clearance is at least $\frac{1}{8}$-inch in small blowers and in large sizes $\frac{1}{2}$ to $\frac{3}{4}$-inch.

The idler, or drum, revolving in the smaller part of the casing, which in the vertical type is above the impeller, is symmetrical and has a periphery nearly a complete circle. It consists of three hollow vanes or blades cast in one piece with the shaft, which is of cast iron, very rigid, and of ample strength to transmit the little power necessary for rotation. The idler, revolving with large clearance, is turned at the same speed as the impeller by means of two spur gears running in oil.

The impeller, mounted on the driving shaft, is made up of three diamond-shaped bars or blades and a central web which is keyed to the steel shaft. Being symmetrical it is perfectly balanced at all speeds. As it revolves three separate pockets are formed in the annular space between the shell and a core extended lengthwise of the lower part of the casing. In reality the core is in two parts, each cast in one piece with the end plates, the space between them allowing the web to revolve.

The cast-iron shell or casing consisting of two hollow cylinders partially intersecting, is accurately bored and amply strong and rigid to withstand the strains due to handling, setting on foundation, and operation at high pressure. The ends of the casing are finished to receive the four cover plates in which are cast chambers or passages for lessening the noise and increasing the efficiency of the machine, as is explained under "Operation." On either side of the housing are openings for the intake and the discharge of the air, flanged and tapped for standard gas pipe fittings ; the small sizes have openings at the sides, and the large blowers openings at the top and bottom. In every respect the casing and rotors are symmetrical, permitting the blower to run in either direction.

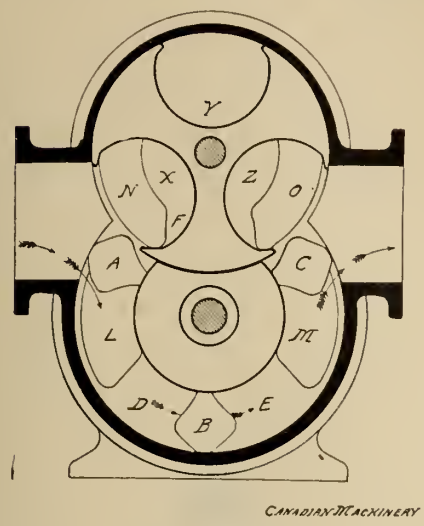
Except in blowers of large size, the lower half of each journal box is cast in one piece with the cover plate, insuring rigidity, simplicity and correct alignment. The boxes, except those for very small blowers, are of the ring-oiling type, lined with Sturtevant white metal, hammered in, and accurately bored.



Side View—Sturtevant High Pressure Blower.

When it is desired to maintain absolutely constant pressure the blower is provided with a relief valve, or auto-

matic governor. For transferring gases and air at high pressure, stuffing boxes are provided for the shafts, and a drain



I

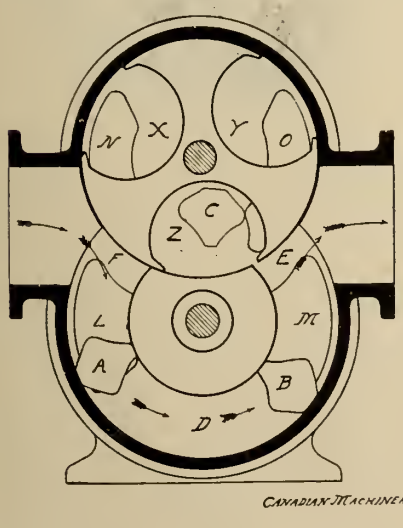
Position One—High Pressure Blower.

in the bottom removes tar and other distilled liquids.

Operation.

Air at atmosphere pressure entering the blower at the intake is successively imprisoned in the three pockets formed by the three blades of the revolving impeller, and discharged at any desired pressure up to ten pounds per square inch. The volume of free air delivered varies directly with the number of revolutions ; the pressure varies with the resistance met in the delivery pipes.

The principle upon which the blower operates is clearly shown by the accompanying diagrams, which are sectional views of the rotors and casing. In the



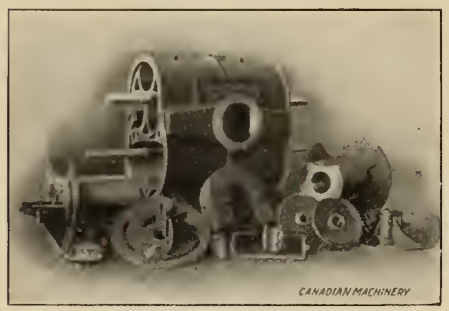
II

Position Two—High Pressure Blower.

explanation it is assumed that the blower is running at a speed to produce average pressure, and that this pressure exists in the discharge outlet.

While the rotating members were in the positions shown in Figure 1, air entered freely and completely filled the chambers (X) and (D), while pockets (E) and (Z) were discharging air to the delivery pipe. From the previous movement of the rotors, the pressure in (Y), filled with air carried over by the revolving idler, had been increased slightly by air flowing through the leakage passage (W) as will be explained later. The space between blades (A) and (C), just above the concave portion of the core, was practically filled by the wing of the idler, and consequently while in this position it took no part in the action.

While revolving from the position of Figure 1 to that shown in Figure 2, the air in pocket (D) has been carried along, and the communication between chamber (D) and the inlet has been cut off. Space (Z) is filled with compressed air, which further movement will carry toward the suction end where it will flow back to the inlet and in escaping cause noise. But this noise and loss is prevented by the leakage chamber (O) which allows the pressure to be transmitted to the air



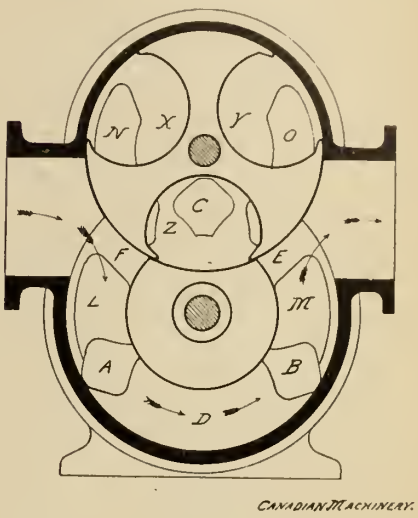
Parts of High Pressure Blower.

in space (Y), thereby increasing its density just before it is discharged.

Continued rotation carries the rotors to the position shown in Figure 3. Atmospheric air is now entering pocket (F), the air in (D) is being carried around between the blades (A) and (B) in the annular space, and (E) is discharging. Above the impeller the remaining pressure in (Z) is being transmitted to the air in (X) by means of the leakage passage (E) provided for the purpose, thereby making its pressure a little greater than atmospheric. The air in space (Y) under slight pressure from previous leakage is imprisoned and being carried around by the idler.

When the fourth position is reached, pocket (F) will be filling, the pressure in chamber (Z) will have been reduced to atmospheric by leakage, space (Y) will discharge and a little compressed air from the delivery pipe will flow back through leakage passage (M) and increase the pressure in (D), which will result in a quieter discharge when further movement brings (B) into the discharge passage.

The purpose and advantage of the leakage chambers is now apparent ; they make it possible to recover the pressure

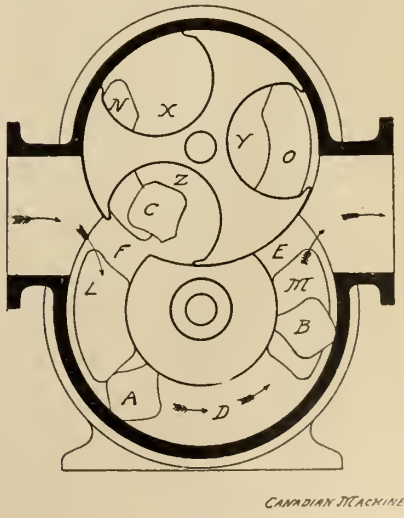


III

Position Three—High Pressure Blower.

tending to escape from the impeller pockets and by making the increase in pressure gradual, cause the blower to run with less noise. Leakage passage (L) has little effect when the blower runs in the direction shown here ; it is made to allow the blower to be reversible.

It will be noticed that the impeller carries three blades, set at equal distances around the periphery, thus causing three admissions of air at each revolution. Upon leaving the position shown in Figure 4 the rotors quickly reach a position in which the conditions are exactly the same as those shown in the



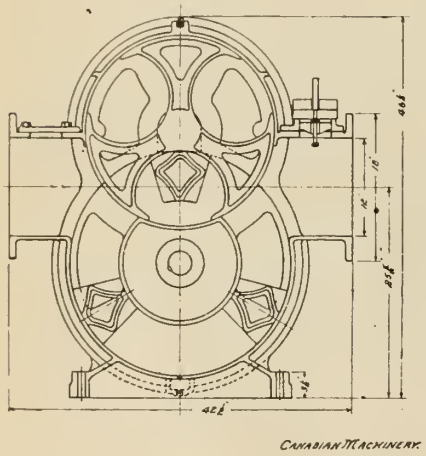
IV

Position Four—High Pressure Blower.

first figure, the operation continuing as explained.

In selecting a blower for the foundry it is customary to rate the volume of

air according to the maximum amount of iron which the cupola can melt. The capacity of the cupola being known, the size of the blower may be found from the fourth column of the accompanying table. If the maximum output is not known the diameter of the cupola becomes the basis for computation, the first column of the table giving the usual capacities for the diameters given in the second column. The values in the third column are based on 30,000 cubic feet of air per ton of iron ; our tests show this to be a fair average, although 23,000 to 40,000 cubic feet may be required, depending upon the local conditions and method of operation. In case a given cupola requires less than 30,000 cubic feet per ton, the blower will melt a larger amount of iron than that given in the table.



End View—High Pressure Blower.

Foundry Table for Sturtevant High Pressure Blowers.

Tons iron per hour.	Usual inside diam. cup. for work inches.	Cubic feet of air per min.	No. of blower.	R. P. M.
1	23	300	4	450
2	27	1,000	5	430
3	30	1,500	6	360
4	32	2,000	7	350
5	36	2,500	6	290
6	39	3,000	8	330
7	42	3,500	9	260
8	45	4,000	9	290
9	42	4,500	9	330
10	54	5,000	10	270
11	54	5,500	10	300
12	60	6,000	10	325
13	60	6,500	11	230
14	60	7,000	11	250
15	66	7,500	11	270
16	66	8,000	11	290
17	66	8,500	11	305
18	72	9,000	12	200
19	72	9,500	12	215
20	72	10,000	12	225
21	78	10,500	12	235
22	78	11,000	12	245
23	78	11,500	12	225
24	84	12 000	13	200
25	84	12,500	13	210
26	84	13,000	13	215
27	90	13,500	13	225
28	90	14,000	13	235
29	90	14,500	13	240
30	90	15,000	13	250

WESTINGHOUSE THREE-CYLINDER COMPOUND AIR PUMP.

By F. H. Parke.

ONE of the latest designs in air pumps is found in the Westinghouse compound air pump, consisting of three cylinders placed vertically in tandem. The two lower ones, joined by a thin centre piece, constitute the air end of the pump, which is surmounted by a centre piece and steam cylinder of the regular Westinghouse type, so that in general appearance this new pump, although somewhat longer, is very similar to that which has been identified with the air brake system throughout the country ever since its inception. The design is very compact and, since the air end only is compound, the additional features required are so similar to old standards that the same simplicity of operation is assured.

This pump can hardly be said to be new, since the Westinghouse Brake Co., in London, have built similar pumps for some years, and have them in successful operation both in England and on the continent of Europe. Therefore, the placing of it on the American market is not in the nature of an experiment as far as the design and operation of the pump are concerned. The application of them to American railway practice is, however, new, and several of the railroads have already placed them in service on trial.

Need of Such.

The greatly increased weight of cars demanding larger brake cylinders, coupled with the increased length of trains, has brought about the expenditure of a much greater quantity of air, and, naturally, the requirement of a larger air pump. This fact brought out the 11 in. pump. With the introduction and general adoption of the high-speed brake and high-pressure control apparatus, the main reservoir pressure was raised from 90 lbs. to 130 lbs. Consequently the work of the pump was thereby greatly increased, and its consumption of steam found to be a factor of considerable importance. The introduction of an air pump designed to deliver the increased amount of air, and at the same time require less steam, has been made a necessity which both the railroads and the air brake companies have for some time past recognized. Such a pump must combine the requirements just outlined with the same simplicity of operation and maintenance, as well as the absolute reliability now had in the standard pumps. Such a pump this three-cylinder Westinghouse compound pump is designed to be.

Compounding.

Generally speaking, the compounding of the air end is done as follows : The two air cylinders are of the same diameter, each having a piston suitably connected to the piston rod, which is actuated by the steam piston. A cast iron cylindrical drum of smaller external diameter than the inside diameter of the air cylinders, projects from one air piston, connecting it with the other in such a manner that the two pistons and drum form a sort of spool. The centre piece between the air cylinders fits

Fig. 1—Front View.

closely about the spool, and has packing rings to prevent the passage of air from one cylinder to the other past the surface of the drum. The low-pressure air is drawn into the top of the upper cylinder and the bottom of the lower cylinder, and during compression is forced through suitable valves and passages to the annular volume formed between the spool, air cylinder walls, and centre piece. The final compression takes place in this annular volume, and the air is forced out through the passages and valves in the centre piece to the discharging opening. It will thus be observed that in each air cylinder both high and low pressures are single acting, but that these pressures on the air piston as a whole are double acting.

The resultant effect, therefore, on the steam piston rod is almost the same as in the simple pump, but the air-cylinder surface being twice as great as in the simple pump affords greater opportunity for radiation of heat, and for that reason the temperature of air discharged is very satisfactory for locomotive service.

Also by thus compounding the air end, a much smaller steam cylinder can be used to operate the pump, causing a marked economy in steam consumption.

General Design.

The present design of pump consists of a steam cylinder 8 in. in diameter by 12 in. stroke, and two air cylinders 11 in. in diameter by 12 in. stroke, while the small outside diameter of the spool is 8¾ in. Consequently the capacity is similar to that of the standard 11 in. pump, which has been on the market for some years, having air and steam cylinders each 11 in. in diameter by 12 in. stroke. The compound pump has an 8 in. diameter steam cylinder instead of an 11 in., as with the standard, and the steam consumption is thereby reduced to about 52 per cent. of the latter through this change alone. But by compounding the air end the capacity of the pump is increased about 16 per cent. when pumping against 90 pounds air pressure, due to the fact that the low pressure clearance volumes at the end of a compression stroke are filled with air at 40 pounds or less, instead of 90 pounds, as in the simple pump, and in the former case this pressure reduces to the atmospheric pressure much earlier during the intake stroke than is possible with the standard pump, consequently the volume of air drawn in at each stroke is that much greater. For higher air pressures this saving is greater.

The air valves, valve seats and valve cages are of the same pattern as those used in the 11 in. pump, while the steam valve mechanism corresponds exactly with that of the 9½ in. pump. Also the piston rings of the two air pistons are similar to the 11 in. pump, and the steam piston rings correspond to the standard 8 in. pump, many of which are still operating on railroads. The steam and air connections, also, are made up of standard pieces that are now in use on the other pumps, so that by the introduction of this new compound the amount of repair stock required outside of that already needed by railroad shops is very small.

Since the working parts are all modelled after those of existing standard, the knowledge possessed by repairmen at the present time will serve them in their work on the new pump without any extended extra instruction. The rules already issued for operating air pumps will in nearly all cases apply to the new pump, so that its introduction, in almost every way, will cause no trouble or inconvenience to the operating departments.

Illustrations.

The cuts illustrating this article will give a clear idea of the design and operation of the pump for those who are interested sufficiently to follow it through. Figure 1 is a front view of the pump, showing the general arrangement. It will be noted that the steam cylinder is made both right and left hand, so that the steam and exhaust connections can be made on either side,

Fig. 2—Side View.

or both on either one side. The lower thin centre piece connecting the two air cylinders contains the final discharge valves and orifice. Each air cylinder has a suction strainer through which the air is drawn into its low pressure volume.

Figure 2 shows a side view of the pump, indicating more clearly the position of the air valves and ports, as well as the lugs for supporting the pump in position.

Figure 3 shows a front central section of the pump, and a side view partly in outline and partly in section. From this cut the operation of the pump can easily be followed through. Steam enters from the governor at the steam inlet and passes through the port (a,) (a,) to the cavity (B) over the main valve; from thence it goes to either the top or the bottom of the steam cylinder exactly as in the present 9½ in. or 11 in. pumps. It is hardly necessary, therefore, to follow this part of the operation through in detail, as that of the standard Westinghouse pumps is not new.

Operation.

The operation of the air end, however, will be of interest. On the down stroke air is drawn in through the upper air inlet on the left hand side of the air cylinder; it passes through the passage (F) and receiving valve port (m) to the low pressure volume above the piston (11). When the piston reaches the lower limit of its stroke and starts upward, this air is compressed until the upper discharge valve (34)—on the upper right hand side of the cylinder—is raised, then the air is forced through port (r',) discharge valve (34,) passage (g',) receiving valve (34) and port (m2) to the annular cavity between the drum portion of piston (11) and the cylinder (5.) Since this volume is much smaller than the low pressure volume, the air is being compressed during its passage from the low to the high pressure volumes, until when the piston reaches the upper limit of its stroke, the air in the low-pressure clearance passage and high-pressure volume has reached the intermediate pressure of approximately 40 pounds.

During the following down stroke, this high-pressure air is compressed until it raises the final discharge valve (34,) when it passes through port (r2) and the discharge valve to the discharge orifice in the centre piece between the air cylinders.

This same operation occurs in the lower cylinder when the piston goes in the opposite direction from that described above, and as corresponding passages are designated by the same letter, the operation can be readily followed through by reading over the description just given.

The air cylinders are lubricated by the automatic air-cylinder oil-cup, (48,) shown in Figure 3, which affords a constant lubrication of an amount automatically regulated to the work done by the pump.

Thus the complication due to compounding is, by this design, materially reduced; all parts are made strong and durable, and as nearly like standard simple pumps as it is possible to make them. In this way the great reliability that has been so prominent a feature of the Westinghouse pumps is made to apply to this one also.

NEW POWER HOUSE.

THE new power house of the Electric Light Company, at Glace Bay, N.S., is being installed with its complement of machinery. The power house has just been completed, being 75 x 42 feet, the contract price of which was $8,000. A retaining wall of solid concrete was built, and inside this wall a steel concrete smokestack 105 feet in height. The power house is divided into two compartments, the boiler room and the engine and condenser room, with a neat little office in the latter. A representative of the Robb Engineering Co., Amherst, N.S., is now engaged in setting up and installing a 375 h.p. Robb-Armstrong, horizontal, tandem compound, Corliss engine, arranged for a direct connection with a 250 k.w. generator, and a 150 h.p. Robb-Mumford boiler, with a steel case. A representative of the Canadian General Electric Company is also engaged in installing machinery supplied by that company. This new machinery, which is up-to-date in every respect, consists of an alternating current revolving field generator, a 12 k.w. exciter mounting an engine shaft operated at a speed of 150 revolutions per minute, and a beautiful blue Vermont marble panel switchboard. This machinery will be supplemented by a large engine and dynamo, and the switchboard now in use, and two of the boilers used in the old building have been moved to the new boiler room. The system now supplies 6,000 lights.

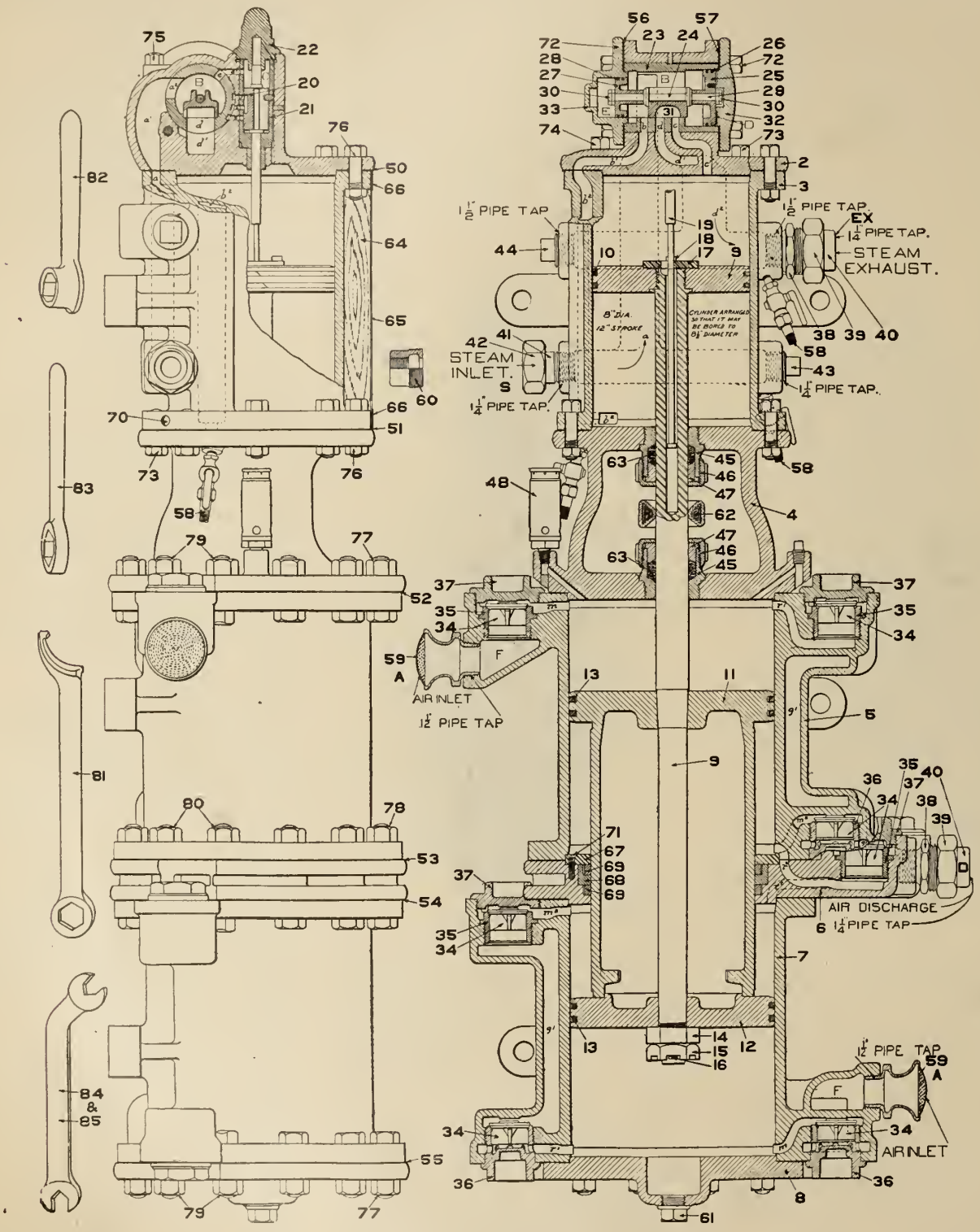


Fig. 3—Detail of Westinghouse Air Pump.

ABOUT CATALOGUES

By mentioning Canadian Machinery to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

Westinghouse Blotters. The Westinghouse Co. are sending out attractive calendar blotters, illustrating their different lines of electric fans.

Green Mattawan is the title of a small booklet just issued by the Green Fuel Economizer Co., Mattawan, illustrating their steel plate blowers and fans. Size, 3 1-2 x 6 inches.

Radial Drills. The Bickford Drill & Tool Co., Cincinnati, Ohio, are sending out bulletins of their 2 1-2, 3 and 3 1-2 foot radial drills which contain complete information concerning these high grade tools.

Gas Boosters. The latest of the engineering series issued by B. F. Sturtevant Co., Hyde Park, describes the safety gas exhausters as boosters, and their application in manufacturing plants. Size, 6 1-2 x 9 inches.

Electric Hoisting Machinery. Bulletin No. 62, issued by the Crocker-Wheeler Co., Ampere, N. J., deals with the adaptability of the electric motor to hoisting apparatus, giving good illustrations and a short description of same. Size, 7 1-2 x 10 inches.

Electro-Dynamic Co. Two bulletins, one describing the motor drive as carried out with the inter-pole variable speed motor of this firm, and in the other some attention is paid to the motor itself. In the latter the method of obtaining sparkless commutation is dealt with.

Canadian Fairbanks Calendar. The Canadian Fairbanks Co. have issued a large calendar suitable for shop or office, which should be an acquisition to any firm. They stated that they would be pleased to furnish this to any of the readers of Canadian Machinery, so same may be had by addressing a card to the above company.

Francis Reed Co. have sent their illustrated catalogue and price list, showing to advantage the different styles of upright drills made by them. These include a wide range up to multiple spindle drills. Their upright nut tapper is also dealt with, as well as drill chucks. Size, 6 x 9 inches.

National Machinery Co., Tiffin, Ohio. Bulletins illustrating the National hot forge and nut machines, and the National hot pressed nut machines, have been received. These lines of machinery have been greatly improved recently and are meeting with signal success on the American and Canadian market.

Crocker-Wheeler Calendar. A calendar for the first three months of the year is being distributed by the Crocker-Wheeler Co., Ampere, N.J. On this is illustrated the 4,000 k.w. alternating current generator manufactured by this firm. Canadian agents are the Packard Electric Co., St. Catharines, Ont.

Twentieth Century Machine Tools. This catalogue, issued by B. F. Barnes Co., Rockford, Ill., contains 74 pages. The main part of the catalogue is devoted to the different lines of drills manufactured by this company, including single spindle and gang drills of all sizes, screw cutting lathes, while punches and chucks are given some attention.

Time Recorder. The new improved premier Canadian time recorder, and the Canadian Magneto watchman's time detector, are described in a fourteen-page catalogue issued by the Canadian Time Recording Co., Toronto. The method of operation is illustrated, and the advantages of this system over many others is dealt with. Size, 6 x 9 inches.

Westinghouse Circuit Breakers. The latest bulletin issued by the publicity department of this firm refers to the Westinghouse Automatic Circuit Breakers, carbon break. These are illustrated and the different points of design explained. Tables are given of sizes, and capacities of different styles. A small folder, with an artistic cover, treats of the Westinghouse pipe thawing apparatus.

Small Tools. A 200-page catalogue of Pratt & Whitney Co., New York, contains perfectly illustrated views of the different small tools manufactured by this company, including amongst others, milling cutters, dies, single and in sets, reamers, threading tools, knurling tools, gauges and many other special lines. At the back of this book are given tables of relative English and metric equivalents, also standard sizes of threading pipe drills, etc. 4 3-4 x 7 1-4 inches.

Pumps. A number of bulletins describing the many lines of pumps manufactured by the Smart-Turner Machine Co., Hamilton, gives some idea of the wide scope of manufacture capable of being produced at this company's works. They include standard duplex boiler feed, automatic feed pumps, centrifugal pumps, independent jet condensing apparatus, compound duplex steam pumps, sewage pumps, single vacuum pumps and many others. These are in bulletin form. Size, 6 x 9 inches.

Industrial Progress. A 300-page pamphlet issued by the Massachusetts Bureau of Statistics of Labor gives an idea of the opportunities for industries that have not yet been utilized in Massachusetts, being part 4 of the annual report for 1905. This gives the different towns and cities in the state, the population, railway connection, and other advantages, besides considerable general information as to the future outlook. Such a publication should have a good effect from an educational standpoint. Size, 5 3-4 x 9 1-4 inches.

Ivel Agricultural Motor. In an interesting series of illustrated folders, the motors manufactured by the Ivel Agricultural Motors, Limited, London, England, are described. To read this and see the wide possibilities of the gasoline or petrol motor in farming, one would think that instead of being one of the most strenuous farming must, with these methods, be indeed a pleasure. Illustrations are given showing ploughing, reaping, harrowing and threshing by machinery. This line of machinery should have a wide field in this country.

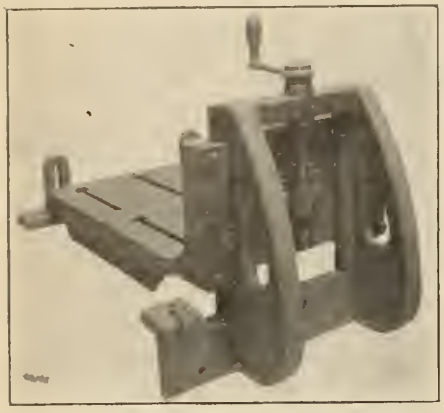
Pedlar People. This is the heading on an unusually attractive and well designed catalogue issued from the head office of the Pedlar People, Oshawa, Canada. It contains an insert showing portraits of the heads of this firm. Throughout is illustrated the many attractive designs of ceiling and wall ornamentation effects manufactured by them. Some of these are particularly artistic, especially the frieze panels. Anyone at all interested in this line of work should have this catalogue. A similar one dealing with accessories and outdoor designs has also been issued and is of equal importance with the other.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

LATHE ATTACHMENT FOR BORING

SUCH an attachment is for converting a lathe to a horizontal boring mill, and is designed to equal the output of a mill both in quality and quantity within its range, and can be

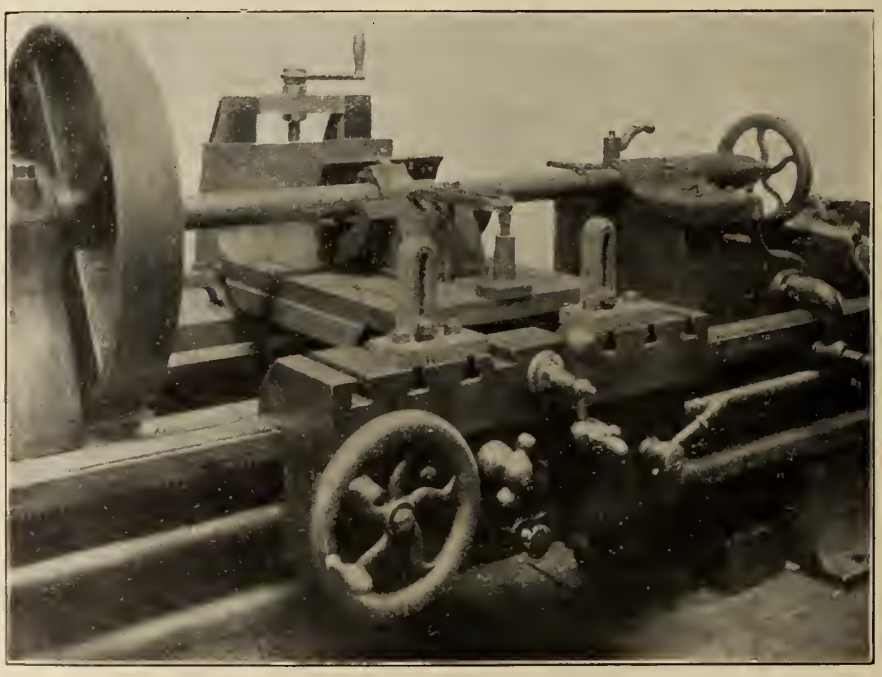


Underwood Drilling Attachment.

made for any size lathe. It consists of a lower plate with an angle projecting down and fastened to the back side of the carriage. The surface of this angle plate is planed true with all the other parts of the attachment. The fastening device has a true planed and well fitted slide with an adjusting screw for elevating to bed for holding the work. For a 30-inch lathe the bed has three T slots for $\frac{5}{8}$ or $\frac{3}{4}$-inch bolts, is 31 inches long, $22\frac{1}{2}$ inches wide, and has $5\frac{1}{2}$-inch vertical adjustment. When set on the lathe carriage it is true with the carriage in all directions—on the upward projection it is planed true, so that work can be set quickly and a place to measure from and set in line with the lathe spindle. By the vertical adjusting screw the table is either raised or lowered parallel with the lathe shears. After being brought into position, the two slotted angle pieces (these having been previously bolted on front of carriage) are firmly attached to table by two screws shown, holding the bed to the lathe carriage. It can readily be seen that it gives a true adjustable bed equal to any well designed machine tool for holding pieces to be bored. No blocking up is required or other slow methods so common when using a lathe for this kind of boring. With this device it takes a very short time to make the change for boring — remove the tool slide, and drill and tap two holes in the back of carriage, lift the device on, and in a very short time it is ready for the work. In practice a 3-inch or $3\frac{1}{4}$-inch diameter bar with suitable cutterheads and automatic feed is desirable, attaching one end of the bar to face plate of lathe, the other end in steady rest or other bearing, and we at once have a powerful boring mill, and do not depend on the lathe centres, which would be the weakest part of this kind of boring. This makes a handy and useful attachment for any shop, weight for 30-inch lathe 685 pounds, of which all sizes are manufactured by H. B. Underwood & Co., 1025 Hamilton street, Philadelphia, Pa.

RAILROAD AND MANUFACTURING SHAPER.

IN the illustration of a 32-inch railroad and manufacturing shaper, is shown the latest product of the Cincinnati Shaper Co., Cincinnati, Ohio. It has been designed to have great power, and at the same time given sufficient rigidity to withstand the peculiar and excessive strain to which it is subjected. The column is of unusual width and depth, is ribbed and braced internally, and of a form to resist to the highest degree the peculiar strains to which it is subjected, and the horns projecting at the front and back give an unusually long bearing to the ram. The ram has a wide and long bearing in the column and is of a form which practice has proven to be the best. The rail is deep, heavy, ribbed horizontally and strongly gibbed to the column, and the cross traverse screw is provided with a graduated collar reading to .001 of an inch, and is also provided with their variable automatic feed, which is changeable from nothing to full feed while the machine is running. There are felt wipers between the column and the rail. The head swivels to any angle and is graduated; the locking device is simple and highly efficient, and the down feed screw is provided with a graduated collar, reading to .001 of an inch. The journal of the main gear has two diameters, (i.e.) the inner end is twice the diameter of the outer; overcoming any tendency to break at the junction of the gear, and there is a third or outer bearing to the cone shaft. The crank block is a steel casting and is set well into the cup of



Multiple Drilling Attachment in Operation.

the gear, permitting the rocker arm to travel close to the edge of the gear; thus avoiding the usual overhang.

There are full-length taper gibs throughtout, adjustable endwise by single screws; namely, for the ram, head, rail, apron and crank wheel slides; affording metal contact on both sides of the gib. This, while more expensive to make, is decidedly preferable to gibs with set screws impinging with varying pressures at the several points in the length of the gib. This machine may be used either in single or back geared form, the ratio of gearing being in the one case seven and two-tenths of the cone shaft to one stroke of the ram, and in the other thirty to one; the highest ratio of any machine of its stroke made. The cross feed connecting rod is automatically adjustable to any height of the rail, and is not dependent upon frictional contact. An outer support, as shown, is regularly furnished with each machine, without extra charge. This, to be of any practical use, demands two conditions, one a base stiff enough to withstand the thrust put upon it, the other that the surface the support rolls or slides on shall be truly parallel with the travel of the table. These conditions are met with in this shaper. Ball bearings are provided under the elevating screw to the rail, and the screw, of telescopic form, never receding below the floor, is out of the way of falling chips. The vise is of their improved double screw form, has a graduated swivelling base, and permits straight or tapering pieces to be securely clamped with equal facility and with rapidity. Its jaw plates are of annealed tool steel.

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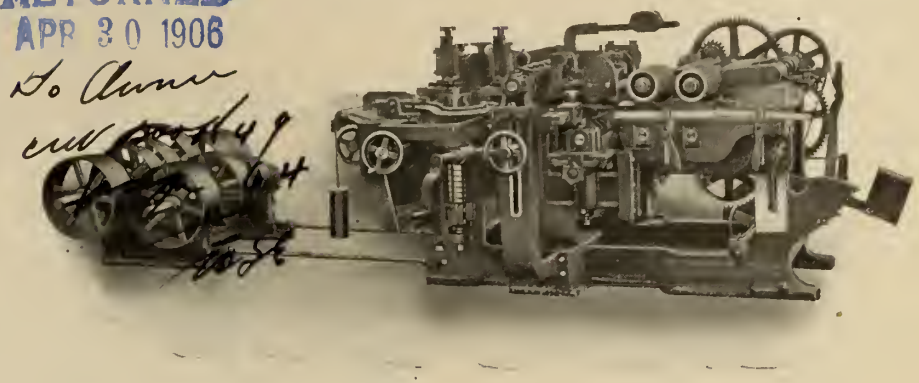
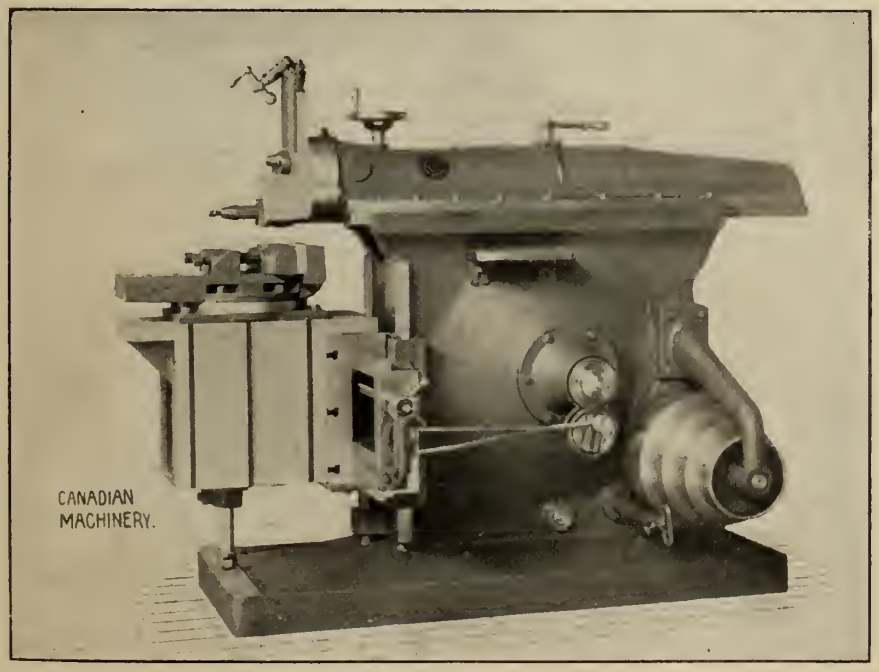


New MacGregor-Gourlay Molder.

Key-seating of shafting and of similar work up to four inches in diameter, is provided for by an opening through the column under the ram. All material entering into the construction of the machine is of the highest class. All shafts are of high point carbon steel, and all are accurately ground in our own shop, and all shaft bearings are long and well braced in the column. All gears and tee slots are cut from the solid; all bearings are amply large, and all flat sliding surfaces, as well as the surfaces between the apron and the table, are hand scraped to surface plates.



Cincinnati Heavy Shaper.

All pinions are of cast steel, and all bevel gears are cut from the solid bar. The rocker arm is strong and heavy. Means are provided for compensating for wear. Convenient means are provided for lubrication, an important consideration. The length of stroke is changed from the working side of the machine, and its position by means of a hand wheel on top of the ram, and these changes can be made while the machine is in motion or at rest.

MacGREGOR-GOURLAY MOLDER.

THE molding machine shown in the following illustration built by the MacGregor-Gourlay Co., Galt, Ont., possesses some new and interesting features. The chief characteristics of the machine are the placing of the countershaft at the rear end, the lower head cutting first, and the variable feed. With these superior advantages it will do more and better work than the old style.

The frame being detached from the countershaft is so designed that all parts dependent upon it are well supported and strongly braced, and metal distributed in a manner to obtain the best results.. The advantages gained in detached countershaft are convenience to operator, more power obtained from belts which deliver straight from side head pulleys, and ample room for belts, avoiding contact with frame or use of idlers.

The lower head cutting first gives the stock a finished surface to rest upon table while the other heads are operating upon it. The table in front of head is independently adjustable to regulate depth of cut, and yoke in which it is contained can be drawn out for adjusting and setting knives.

The pressure shoe and bars which are necessary in connection with cutter heads above the table have vertical and longitudinal adjustments and are arranged to swing entirely clear of heads to give access for adjusting and sharpening knives. The pressure shoe for side head in table is weighted, and adjustable to and from knife. The entire table with all its attachments is raised and lowered by screw and crank. Ball bear-

ings are introduced to take thrust and carry weight, making the adjustment easy for operator. Tightening bolts and nuts are provided with hand wheels or levers, which saves time in completing adjustments.

The variable feed is one of the most important features of this machine, and is described in article on molder design in January issue. A variation from to 60 feet per minute can be obtained by simply moving a lever.

The mechanism is of ample strength to withstand hard and continuous service, and can be relied upon to feed against any depth or width of cut.

The gearing in connection with this feed is powerful, and so arranged that upper rolls are driven downward upon stock. The design and the high standard of work entering into the construction of this machine puts it in the forefront of modern molders.

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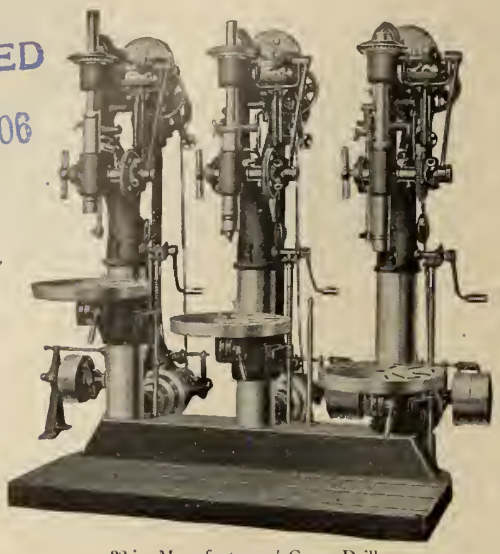
APR 30 1906

MANUFACTURERS' GANG DRILL.

GANG drills of various capacities are manufactured by B. F. Barnes Co., Rockford, Ill., the latest of which, a 23-inch manufacturers' gang drill with self-operating spindles, independent table style, is shown herewith.

The spindles in this style are set on a heavy bed base and are provided with back brace, making an exceedingly rigid, strong and powerful machine for its size, and is furnished with or without back gearing as desired. The spindles are self-acting, requiring only the throwing of the trip lever, when the spindle immediately descends very rapidly to the work at which point the feed is automatically thrown in and the spindle begins to drill at regular speed ; as soon as the automatic stop trips, the spindle rapidly returns to original position



32-in. Manufacturers' Gang Drill.

ready for the next operation. There are no feed levers to bother with, hence the operator has practically all of his time for taking the work to and from the machine. Each spindle has independent feed and independent speed. The individual column style provides for independent, adjustable tables for variation in heights of work. The tables are regularly furnished in round style, but when oil pump attachment is required, square tables are supplied with oil channel, the extra charge being made only for the oil pump attachment. The machine can be used for boring and reaming work equally well. It is especially adapted for the use of high speed steel on work requiring durability under constant use. It will regularly handle work up to a 2-inch cored hole, but where required for still heavier work, extra heavy crown gear and pinion is furnished which gives capacity up to 3-inch cored work.

HEAVY WOODWORKING MACHINES.

AS examples of heavy woodworking machines, two manufactured by the Berlin Machine Works, Beloit, Wis., are shown in the accompanying illustrations, Fig. 1 representing the Invincible sander, and Fig. 2 representing a planer, matcher and sizer. In reference to the latter, an important feature of this tool is the location of the lower cutter head, which cuts first. This not only produces much better results in working thin stock, but, in running timbers, it tends to straighten the crooked pieces, which in other machines would be difficult to feed. The lower in-feeding rolls and bar before the lower cylinder are adjusted by means of a lever at the in-feeding end for changing the cut of the lower cylinder from

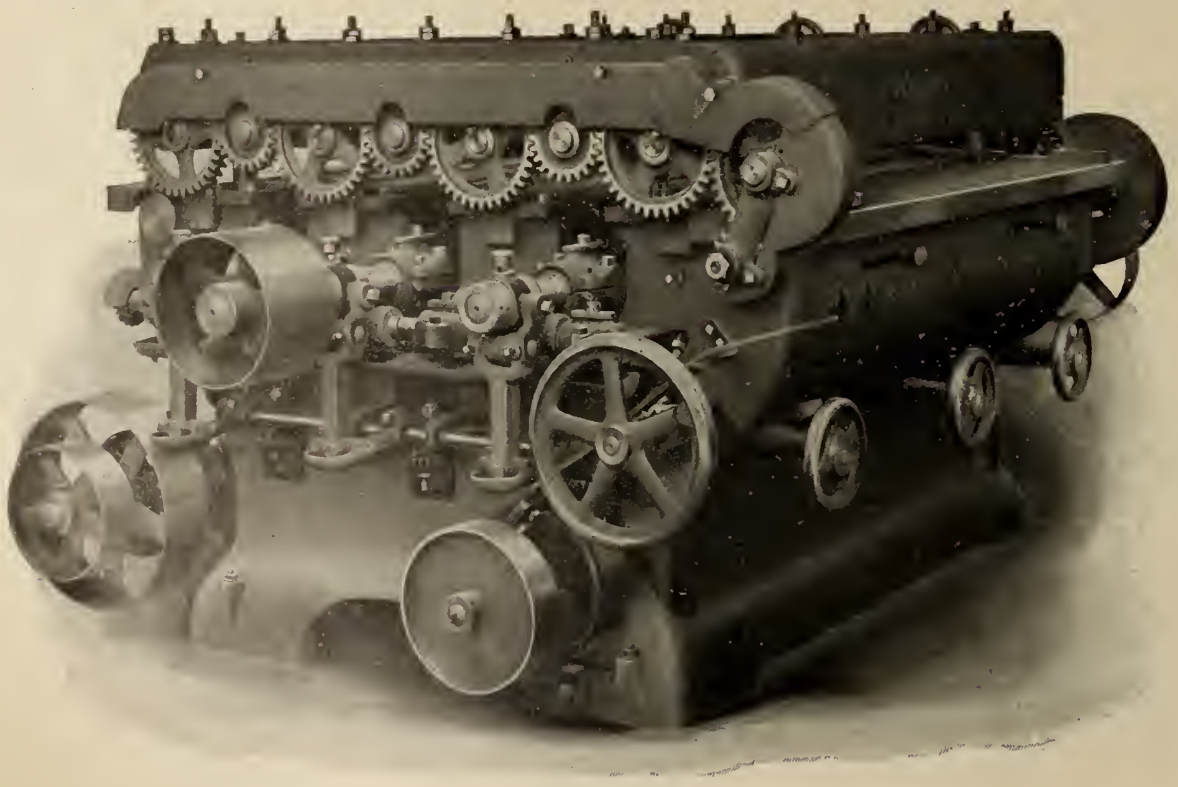
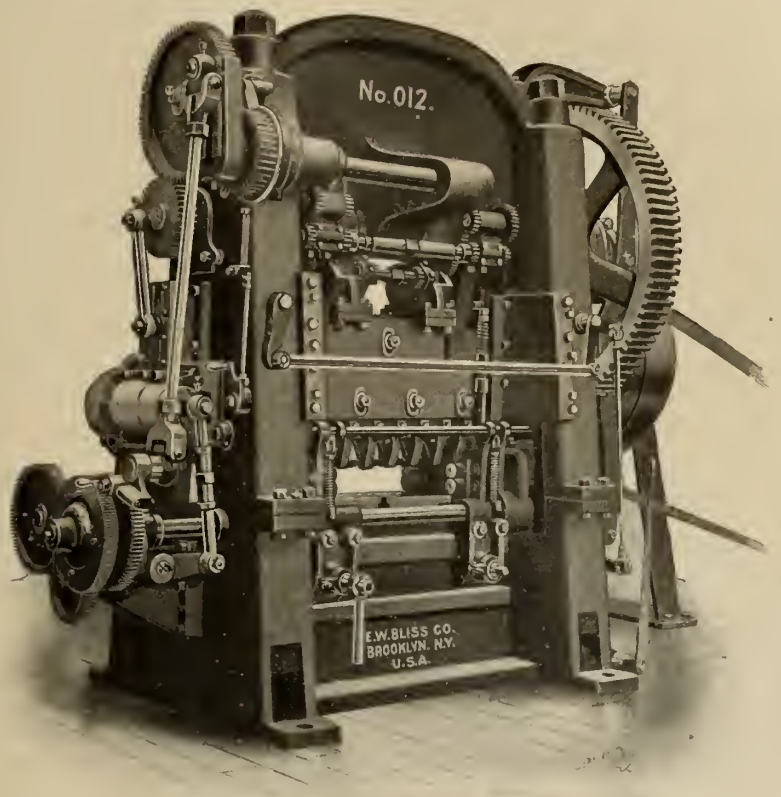


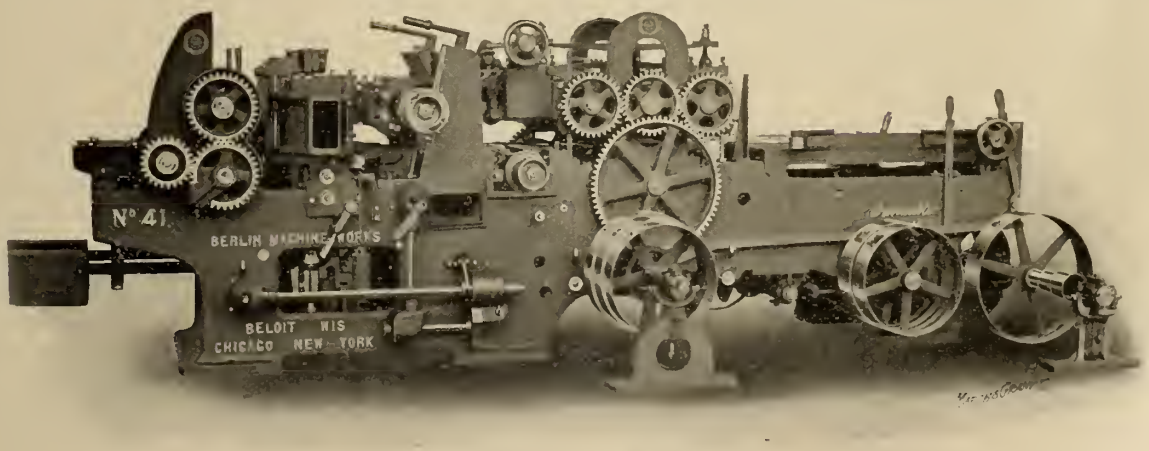
Fig. 1—Invincible Sander.

0 to 1-4 inch. The under head is arranged to draw out at the side of the machine for convenience in sharpening and setting of knives. The top rolls, upper cylinder, pressure bar and chip breaker are adjusted simultaneously, or the in-feeding rolls independently by power. Like results are obtained by hand when desired. No gears run on studs. All cutter heads are square and slotted, four sided. Top and bottom heads, each double belted. All cylinder pulleys are pneumatic.



Multiple Punch Press.

The sander is built in sizes from 30 inches to 102 inches in width. Three drums are used, carrying different grades of paper—coarse, medium and fine. Following the drums is a brush cylinder, which serves to keep the last lower feed roll clean, thus preventing marring of the finished stock by dust particles, which otherwise would collect upon the roll. All drums have an oscillating motion which removes scratches caused by imperfections in the paper. Each drum may be independently adjusted at either end, and, to determine the cut, may be simultaneously adjusted and locked at both ends by means of a hand wheel at the in-feeding end. Eight powerfully driven feed rolls are used—four above and four below—and each may be independently adjusted and securely locked at each end. The upper frame carrying the feed and pressure rolls may be quickly adjusted by power and accurately set by a partial turn of a hand wheel convenient to the operator. The feed may be instantly started or stopped by shifting either of the buttons shown just below the in-feeding table, or by a lever at the rear of the machine, either of these buttons or the lever operating a clutch on the feed shaft. The drum is the most important part of a sander, and it is this feature of the Royal which has put it in a class by itself. The drum is so constructed and the paper so applied to it, that it is continuous cutting. It leaves no marks like the ordinary drum, having a longitudinal opening through which the edges of the paper must pass for clamping.



Invincible Planer, Matcher and Sizer.

A NEW BLISS MULTIPLE PUNCH PRESS.

HEREWITH is shown a new multiple punching press especially designed by the E. W. Bliss Co., Brooklyn, N. Y., for operating narrow dies of great length. Although the holes punched by the press are usually not large, the number of them produces an enormous strain, and, therefore, a heavy press is required. It is particularly adapted for gang punching work, such as plates for boilers and tanks, or other large sheet metal articles and tools, and perforated sheets requiring a large number of perforations.

The press is fitted with a cam actuated stripper, which permits of much shorter, and, therefore, more durable punches than can be employed with stationary strippers. This stripper comes down upon the metal, straightening it out before and holding it straight during the punching and stripping. After stripping it moves up with the punches. This arrangement presents the additional advantage of obviating the blow

against the lower side of the stripper plate, which, with stationary strippers, occurs upon the return stroke of the slide, because of the necessary play between the die and the fixed stripper, which permits the punched bar or sheet to be carried up against the plate before stripping.

Another notable feature of this press is that it is fitted with open feed rolls, adjustable to take any size of sheet up to 50 inches wide. The feed rolls are provided with a side motion which automatically shifts the sheets and rolls sideways at each stroke for the purpose of permitting the perforating of a staggering pattern by means of a single row

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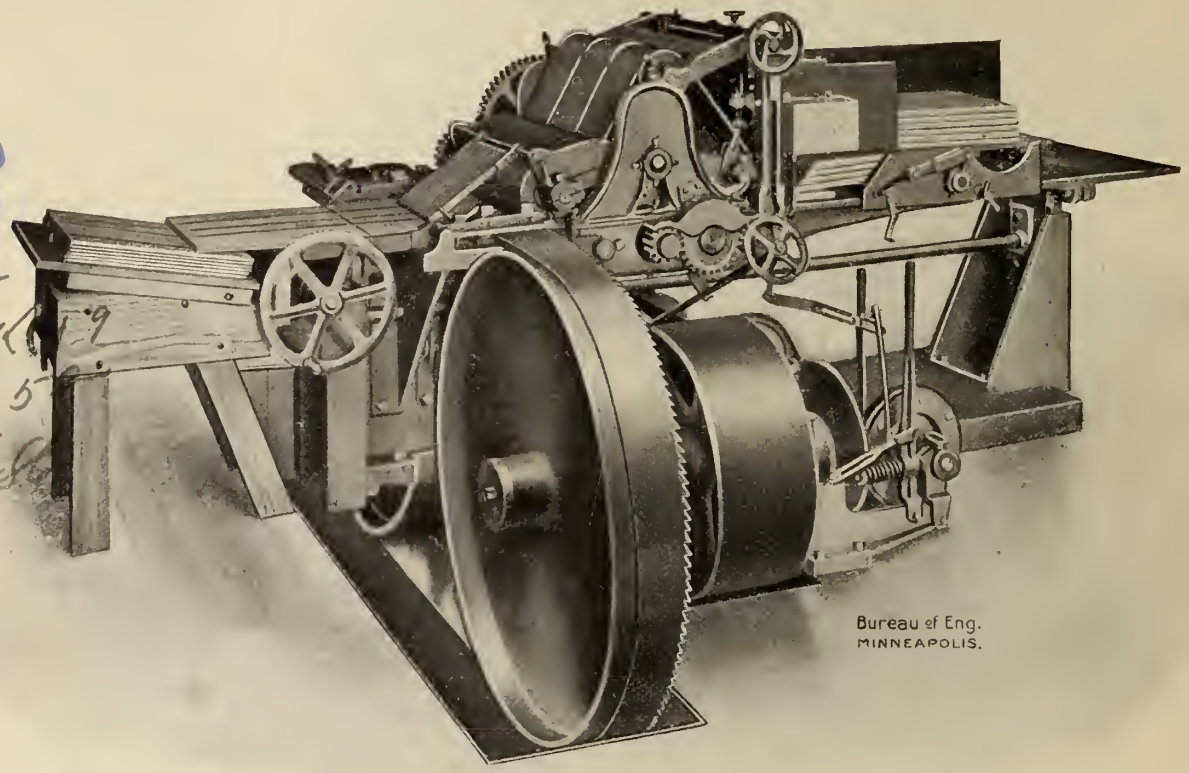

Cowan Boxing Machine.

die. This reciprocating motion, which shifts the rolls, can be easily adjusted for different patterns. A great advantage accruing from the use of a single row die, that will be readily appreciated, is that the intermediate holes in the dies being omitted, the remaining ones may be fitted with steel bushings set in a machine steel holder, avoiding the difficulties of satisfactorily hardening multiple dies made entirely of tool steel, and permitting of quickly repairing the damage done to any one of the dies by putting in a new bushing. In addition to this staggering motion the rolls have a variable feed motion quite original in design. This mechanism enables the rolls to feed an equal distance for two or three strokes, then varies the length of feed before making the next stroke. For instance, in a period of three strokes of the punch slide, the rolls may be fed two short and one long distance, or vice versa, or all three spacings may be equal. By substituting other ratchets and gears, a number of combinations may be obtained, thus securing a considerable variety of spacing or grouping of the row of holes.

The frame is built up in sections held together with four steel rods 4 1-2 inches in diameter, which materially strengthen the frame and take the strain when the press is in operation. The crank shaft is a solid steel forging 7 1-2 inches in diameter. The main gear, clutch, balance wheel, tight and loose pulleys are all on left hand side of press, supported by an out-board bearing. This arrangement leaves both the front and back of press free from all mechanism which might in any way interfere with the operator. The clutch mechanism is of the jaw type, and is actuated by an air cylinder. Alongside of the fly-wheel, which is 50 inches in diameter and 10 inches wide, is another wheel of the same dimensions, drilled with 12 socket holes, equally divided around the circumference, to receive starting levers for turning the machine over when setting the dies.

BRITISH POWER HAMMERS.

A NEW power hammer has just been placed on the market by Peter Pilkington, Limited, 75a Queen Victoria street, London, that is altogether different from former makes. This firm are pioneers in the matter of air compressor hammers, having furnished them to the English and foreign governments and to most of the leading shipbuilders and engineering firms in Great Britain.

The great advantage of this new hammer, which has compound cylinders and is worked from a separate air compressor, lies in the fact that where firms have a number of hammers and are dispensing with steam this hammer can be substituted and an air compressor electrically or otherwise driven to take the place of steam boilers. These hammers are remarkable for their very great economy as the high pressure air which has made the blow of the hammer is stored and used over again for lifting the piston and for light work. This firm are prepared to guarantee a saving of 50 to 60 per cent. in power as compared with steam, and in many cases will undertake to convert existing steam hammers by taking off the steam cylinders and replacing them with the company's patent compressor cylinder. An order for no less than 24 of these hammers has just been filled for a large shipbuilding works near Glasgow, with other orders pending from the same firm. It is intended in a subsequent issue to give a more detailed account of these hammers.

Companies Incorporated

Warden King & Son, Montreal, have been authorized to carry on business in the Province of Ontario in pipes, steam fittings, plumbers' supplies, etc., with a capital of $40,000.

The Colonial Cordage Company, chartered by the Dominion Government, has been licensed to do business in the Province of Ontario, with W. B. Converse, of Toronto, as attorney.

Elevator Specialty Company, Toronto, share capital $40,000, purpose to manufacture elevators and machinery. The directors are: G. A. Matthews, W. J. Feeney and G. Ritchie, all of Toronto.

Silver Bar Mining Co., Ottawa, share capital five hundred thousand, purpose to mine and mill minerals. The directors are W. D. Gregory, H. F. Gooderham, H. N. Barry, R. Weir and J. F. Boland.

The Lake Superior Corporation, a company incorporated in the State of New Jersey, has been given the right to carry on business in Ontario, provided they do not use a larger capital than $1,000,000.

Mac Mining Company, Toronto, share capital three hundred and fifty thousand, purpose to develop mining property. The directors are D. A. McPherson, Toronto, Geo. Chapman and W. E. Buckingham, of Guelph.

Siche Gas Co., Toronto, share capital $100,000; purpose, to manufacture, sell and operate gas apparatus and supplies. The directors are F. L. H. Sims, J. H. Chewett, and R. G. Hunter, all of Toronto.

Thorold Natural Gas Co., Toronto, share capital $40,000; purpose, to refine petroleum oil, natural gas, manufactured gas, or electricity. The directors are C. A. Moss, W. Gilchrist, and J. A. Thompson, all of Toronto.

Canadian Lock Nut Company, Toronto, share capital $300,000, purpose to manufacture lock nuts, bolts and machine fittings of all kinds. The directors are: A. G. Slaght, T. L. Monahan and E. C. Spereman, all of Toronto.

Fletcher Manufacturing Company, Toronto, share capital $250,000, purpose to manufacture bakers' tools, soda fountains, hardware, glassware, woodenware, etc. The directors are: B. Fletcher, E. Whaley and E. B. Fletcher, all of Toronto.

The Dominion Steel Car Co., Montreal, share capital five hundred thousand, purpose to manufacture railroad rolling stock. The directors are E. F. Surveyor, A. C. Casgrain, C. M. Cotton, J. W. Weldon and S. J. Lehuray, all of Montreal.

Vermillion River Iron Ore Co., Toronto, share capital $80,000; purpose, to carry on the operations of a mining, milling, reduction and development company. The directors are F. J. Denton, J. W. McDonald and Ella A. Francis, all of Toronto.

C. Parsons & Son, Toronto, share capital $150,000; purpose, to carry on the business of tanners, dealers in hides, leather, etc. The directors are C. Parsons, W. G. Parsons, Frances S. Parsons, Alice E. Parsons, and J. E. Boswell, all of Toronto.

C. Tompkins, of New York; Hon. H. W. Ladd, Boston, Mass.; W. Tompkins, Tompkins' Cove, N.Y., and C. J. Osman, of Hillsboro, N.B., have given notice of applying for incorporation as the New Brunswick Gypsum Company, Limited, with a capital of $30,000.

The Edmonton Lumber Co., capitalized at $60,000, has been organized, and a logging camp has been established eighty miles above Edmonton, on the Saskatchewan River, where a large mill will be erected. A. H. Clark, Edmonton, is promoter of the enterprise.

New York & Canadian Mining Co., Toronto, have been incorporated with a share capital of $40,000, for the purpose of carrying on the business of a mining, milling and reduction company. The directors are G. R. Geary, F. D. Byers, and O. F. Taylor, all of Toronto.

The Pittsburg-Cobalt Co., Toronto, share capital $75,000; purpose, to carry on the operations of a mining, milling, reduction and development company. The directors are C. D. Robbins, S. F. Heckert, W. A. McCutcheon, H. O. Patch and S. M. McElroy, all of Pittsburgh, Penn.

St. Lawrence Pressed Brick & Terracotta Co., Montreal, share capital two hundred and ninety-nine thousand, purpose to manufacture brick, etc. The directors are A. W. Blouin, O. Frechette and A. Brunelle, all of Montreal, and R. Lefebvre and F. C. Larose, of LaPrairie, Que.

The Robert Gardner & Sons Company has been incorporated to carry on business such as the manufacture of machinery, etc. It is composed chiefly of Montreal capitalists, with a total capital stock of one hundred and forty-five thousand dollars, and its chief place of business will be Montreal.

Dymond Development Co., Ottawa, share capital $250,000; purpose, to carry on the business of a mining, milling, reduction and development company. The directors are C. W. F. Gorrell, A. T. Shillington, of Ottawa, and B. J. Arnold, W. L. Arnold, and R. G. Arnold, of Chicago, Ill.

Canadian Voting Machine Company, Niagara Falls, share capital $100,000, purpose to conduct a general foundry and machine business. The directors are: C. F. Roland and A. M. Ecclestone, St. Catharines; J. T. James and J. R. Mencke, Bridgeburg; and W. E. Curran, Buffalo, N.Y.

The Central Heat, Light & Power Company, Limited, has been incorporated, with a total capital stock of $500,000. with its chief place of business in Montreal, to carry on the business of a light, heat and power company in all its branches. The company is composed chiefly of Montreal capitalists.

The Ontario Cobalt Developing Co., Toronto, share capital $350,000; purpose, to carry on the operations of a mining, milling, reduction and development company. The directors are S. M. Hay, J. W. Curry and E. E. Wallace, of Toronto; J. Bingeman, of Berlin, and J. K. Paisley, of Ottawa.

Meakins Brush Co., Montreal, share capital sixty thousand dollars, purpose to take over the business of Meakins, Sons & Co., manufacturers of brushes, etc. The directors are C. W. Meakins and W. G. Meakins, Hamilton, Ont.; F. A. Ritchie, Toronto; C. W. Meakins, H. R. St. Michael, J. J. Robson and M. Thivierge, all of Montreal.

The Excelsion Babbit & Car Bearing Co. has been organized at Moncton, N.B., by Joseph R. Stratton, R. A. Borden, E. M. Jones, Jas. D. Ross, Moncton; and Edmund Simpson, Petitcodiac. The object is to manufacture and deal in babbit and other anti-friction metals, car bearings, etc. The capital stock is to be $190,000.

The Sudbury Machine Shop & Foundry Co. have been incorporated with a share capital of $40,000, for the purpose of carrying on the business of mechanical engineers, machinists and foundrymen, the provisional directors being D. H. Haight and John Lawson, Copper Cliff; A. B. Gordon and L. O'Connor, Sudbury, and O. R. Smith, Victoria Mines.

Campbell & Tough Stock Scale Co., Arnprior, have been incorporated with a share capital of $50,000, for the purpose of manufacturing and dealing in weighing machines, refrigerators, etc., and carrying on the business of woodworkers, machinists and founders. The directors are D. J. Campbell, Arnprior; R. J. Tough, Toronto, and D. Craig, Renfrew.

The Canadian Consolidated Mines, Toronto, have been incorporated by Dominion charter, with a capitalization of $5,500,000. The incorporaters include H. S. Osler, W. B. Raymond, E. Ford, J. M. Ewing, and Britton Osler, and the company is organized for the purpose of amalgamating several successful mines at Rossland with the Trail Smelter and the Rossland Power Company.

Dominion Brazing Co., Montreal, have been incorporated with a share capital of $100,000, for the purpose of carrying on a business of brazing, welding, soldering, repairing, etc., and to manufacture and deal in all goods used in connection therewith. The directors are A. Hendery and W. Eckenstein, of Montreal; H. L. Dinning, Lachine; C. Ralph, Longueuil, and C. A. Duclos, Westmount.

Two powerful contracting syndicates were incorporated last week, one to be known as the MacArthur Construction Co. of Canada, with a capital of six million dollars and headquarters at Montreal. The incorporators are Archibald and A. F. MacArthur, of Chicago; J. R. MacArthur, of New York, and W. J. Poupore, of Montreal. The other is to be known as the Empire Construction Co., headquarters in Montreal, and a capital of one million. The incorporators are J. B. Tudhope, of Orillia; H. W. Fleury, of Aurora; P. Galibert and T. Gauthier, of Montreal, and a number of distinguished Belgians.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

A new electrical company is being promoted at St. John's, Nfld.

The Eagle Spinning Mills Company are to establish a large plant at Hamilton.

A large new saw mill is to be built at Beaudette, on the Rainy River, next Spring.

The London Machine Tool Co. will remove their plant to Hamilton in February.

The Sawyer-Massey Company, of Hamilton, are to erect a large warehouse at Saskatoon.

The Niagara Engine Works at Niagara-on-the-Lake, Ontario, has been put in operation.

R. P. Inglis, Montreal, is making preparations to establish a street railway at Edmonton.

Keenan Bros. will extend their woodenware factory at Owen Sound at a cost of $25,800.

A beet sugar plant is proposed at Chatham, Ont., to be financed by American capitalists.

The Backus-Brooks syndicate are to erect a lumber mill in the vicinity of Fort Frances, Ont.

The Terminal Warehouse and Cartage Co., Montreal, are to erect a $200,000 fireproof warehouse.

C. Lloyd & Sons, Wingham, are considering increasing their plant, installing new machinery, etc.

The Niagara Engine Works are to be put into operation shortly. Orders for 30 engines are on hand.

C. Anderson, St. Louis, and T. Morton, Chicago, may establish a smallwares factory at Sarnia.

Messrs. Knight & Stitt will erect a new flour mill at Eganville with a capacity of 100 barrels a day.

New coal fields at Beaver Lake, near Edmonton, are reported to be of a very high grade of bituminous coal.

A large brickmaking plant employing 150 men is to be established at Clayburn, near Mission City, B.C.

The International Silver Company, Welland, are installing considerable new machinery and electric equipment.

A hydraulic engineer is to investigate the subject of developing power at the Reversible Falls at St. John, N.B.

The Climax Road Machinery Co., composed of American capitalists, may establish a Canadian factory at Guelph.

Sheldon & Sheldon, Galt, Ont., are installing a dry kiln apparatus for the Improved Match Co., Drummondville, Que.

McInnes & Lyons have established a planing mill at Edmonton, in connection with their large saw mills near that city.

The B. C. Electric Railway Co. are to erect a power house at North Vancouver, for their new tram line at that place.

The Canadian Pacific are rapidly pushing ahead the work of double-tracking between Winnipeg and Fort William.

The Canadian Pacific Railway propose to construct a line of railway from Woodstock to Niagara Falls, through Hamilton.

Work on the big power plant at Fort Frances is progressing favorably, and it is announced that a pulp mill will be built there.

A shipment of 100 cars of steel rails has been made from the "Soo" to be used by the C.P.R. between Fort William and Winnipeg.

Sheldon & Sheldon, Galt, have just closed the contract for the heating, ventilating and drying apparatus for Stauntons, Limited, Toronto.

Sheldon & Sheldon, Galt, Ont., are installing drying apparatus for the Canada Glue Co., Brantford, and for the Canada Coating Mills, Georgetown.

The name of the Cobban Mfg. Co., Toronto, has been changed to the Phillips Mfg. Co. The personnel of the company remains unchanged.

The Fraser River Tanning Co., Limited, New Westminster, B.C., are installing a heating apparatus supplied by Sheldon & Sheldon, Galt, Ont.

The Miramichi Lumber Co. will establish a mill at Chatham, N.B. The plant and building will cost $50,000, and 60 men will be employed.

The Wellington Colliery Co., Victoria, B.C., are to commence boring operations on a new discovery of coal near Parksville, not far from Nanaimo.

The International Coal & Coke Co. are to install 100 new coke ovens. The increase in the daily production will be from 800 to 1,000 tons of coke.

Willis Chipman, Toronto, has prepared plans for the development of water power near Prince Albert, Sask., to supply that town with water.

The Quebec Central Railway intends to build several branch lines this year, and will enter Quebec City over the new bridge when it is completed.

The Credit Foncier Franco-Canadien has purchased a site in Winnipeg, with a frontage of 60 feet, and will build a large bank structure next Spring.

John Bertram & Sons, Dundas, have ordered from the Smart-Turner Machine Co., Hamilton, an automatic feed pump and receiver for their new factory.

Contracts have been signed and it is now assured that the Patent Roofing Company of Lafayette, Ind., will establish a branch factory at Brantford.

British Columbia shingles have been advanced to $1.85, an advance of 15 cents. It is said all grades of B.C. lumber are to be moved upward in price.

W. H. Northcote, Hamilton, has secured a permit to build a brick house in that city, to cost $1,800, and Mark Lawrence is to build one to cost $1,700.

James A. Ross, Wellandport, is promoting a company to operate an electric railway from Port Maitland, on Lake Erie, to Beamsville, on Lake Erie.

It is said that the Lake of the Woods Milling Co. propose duplicating their large mills at Keenwaning. Engineers are now at work on the surveying of a site.

Tenders have been asked for the construction of 450 miles of Grand Trunk Pacific from Touchwood Hills, 225 miles west of Portage La Prairie, to Edmonton.

An important pulp wood industry in which from $1,000,000 to $2,000,000 will be invested is to be established in the Back River district near St. Jerome, Que.

The Canadian Machine Telephone Co. has been granted a twenty-one year franchise by the city of Brantford. The price of the 'phones is to be $15 to $25.

L. O. Grothe & Co., cigar manufacturers, Montreal, have purchased a site for $32,500, and propose to erect factory buildings, etc., to cost about $200,000.

William Russell, representing the Independent Harvesters Company, of Chicago, has written Mayor Ferguson of Stratford in regard to locating a branch there.

Niagara Falls, Ontario, now has a factory in operation turning out machines for making concrete blocks. It is that of the Vining Brothers Manufacturing Company.

Sheldon & Sheldon, Galt, Ont., are installing leather drying apparatus for the Lang Tanning Co., Berlin, for the Acton Tanning Co., Acton, and for Beardmore & Co., Acton.

Legislation will be introduced at the coming session of the Ontario Legislature for the purpose of securing the refining in Ontario of all nickel produced in the province.

The Restigouche Woodworking Co. have completed the construction of a large woodworking plant at Dalhousie. The plant is said to be the most modern in New Brunswick.

The Canadian Tap & Die Company, who recently purchased the Clark & DeMill building at Galt, have received a consignment of thirteen machines, which are now being installed.

The Canadian Northern Railroad will spend $2,600,000; orders placed embracing 400 box, 400 flat, and 50 stock cars, 30 coaches, 16 baggage cars, 7 sleepers and diners, and 44 locomotives.

About one hundred men will move to Toronto from Stratford on account of the transfer of the factory of the Kemp Manure Spreading Machine Co. to Toronto by the Massey-Harris Co.

It is announced that the Canadian Northern Railroad will build a road to

skirt the north shore of Lake Superior, connecting their lines in Manitoba with their lines east of Georgian Bay.

The British Columbia Electric Railway Company have placed orders for electric machinery and equipment worth $125,000, to be used in enlargements of their power plant near Vancouver.

The N. B. Electrical Power Co., St. John, intend to establish a large electrical power plant at Aroostook Falls, and will have it in working shape before the Grand Falls plant is in operation.

Winnipeg financiers will establish an industry at Medicine Hat to be known as the Great West Sewer & Tile Company, with a capitalization of $1,000,000. Brick and tile will be manufactured.

The Lake Superior Box Company, West Superior, Michigan, have purchased a site in Winnipeg and intend to erect a five-storey factory building. Machinery to the value of $70,000 is to be installed.

The Klondyke Mines Railway is to be built from Dawson to Stewart Crossing, a distance of 84 miles. T. W. O'Brien has been in the east and has successfully arranged the financing of the project.

A company is being promoted to supply the town of Shelburne, N.S., with electric light and electric power. They will get their power from the Roseway River and expect to develop about 3,000 horse-power.

Manson Campbell, president of the Chatham Fanning Mill Co., has bought a site at Brandon, Man., for $10,000, and it is understood that the Chatham company proposes erecting a wholesale depot in Brandon.

The Wellington Colliery Co. has begun operations to open up a new coal field several miles from Wellington, where a splendid seam has been discovered. The firm of R. Dunsmuir & Sons control the Wellington colliery.

Amongst other new machinery installed by W. H. Banfield & Son, 120 Adelaide street west, Toronto, in their new plant is a 30x30-inch planer with an 8-foot bed, manufactured by John Bertram & Sons, Dundas.

Prescott expects to secure electric power this Spring from the Ogdensburg Light & Power Company, which secures its power at Hannawa Falls, and intends to look for business on the Canadian side this season.

An electrical expert has reported that there are from 12,000 to 13,000 horsepower to be generated, except in the dry season, at the power plant at Erindale, which was established with York County Loan Company money.

According to the report of the Ontario Bureau of Mines, the total mineral output in Ontario during 1905 amounted to $11,572,647. The report is in three parts, and can be obtained on application to the department.

There are now eighteen shipping mines producing zinc in British Columbia, the total production during 1905 amounting in value to $273,000. The operation of the smelting plant at Frank will give the industry a boom during 1906.

Three hundred tons of steel rails are being shipped to North Vancouver, where they will be used in the construction of a tram line through the townsite recently laid out across the inlet from the city of Vancouver.

It is proposed to establish a steel billet mill in connection with the Portland Rolling Mills at St. John, N.B. Such a plant would cost about $200,000 to construct, and another $100,000 would be required for its operation.

Lang Tanning Co., Berlin, have installed a complete system of electric drive for their factory, the electrical machinery being supplied by the Canadian General Electric Co. and the power plant by Goldie & McCulloch, Galt.

In 1905 the Granby smelter treated 650,000 tons of ore, and in 1906, with its two new large furnaces and with its six old furnaces enlarged, it should treat 85,000 to 90,000 tons of ore per month, or at least 1,000,000 tons for the year.

A new Singer Sewing Machine factory at St. Johns, Que., is now nearly completed, and represents an outlay of about $1,000,000. The plant covers 45 acres and has 18 separate buildings, all of modern steel construction and fireproof.

Cowan & Co., Galt, Ont., have just completed the almost complete equipment of Gardner's saw and planing mills, Galt, including a 42-inch sander, a 13-inch molder, a 42-inch band re-saw, a door clamp, a variety saw and a mortise machine.

Britton & Hedges, Boston, have placed a proposition before the town of Port Arthur regarding the location of a boiler tube and barbed wire works at that town. The company will employ 800 men and establish a $700,000 plant if a deal is completed.

Much interest is evoked by the announcement that the gross production of mines in British Columbia is estimated to exceed $20,000,000, more than twice the output of the Klondike. Last year the mineral production of the province was $18,977,359.

The Canada Foundry Co. have recently secured a large contract for the superstruction of Fredericton highway bridge. It is said that nearly 300 tons of steel will be required on the installation, and that it will be completed early in the Spring.

The Niagara Falls Foundry & Machine Co. has work enough ahead to keep it busy casting every day until April 1. The orders include the big pipe for the Ontario Power Co.'s elevator incline, between transforming station and power house.

Sheldon & Sheldon, Galt, are supplying induced draft apparatus to the Brunette Saw Mill Co., New Westminster, B.C., to the Pacific Coast Lumber Co., Vancouver, to the Bowman Lumber Co., Revelstoke, B.C., and to the Revelstoke Lumber Co., Revelstoke, B.C.

A company of English and American capitalists propose to construct a railroad from a harbor on the north shore of Lake Superior into the country north and beyond the height of land. They also propose to establish pulp wood mills in connection with the road.

Two diamond drills are to be used in developing the large coal areas near Nicola Lake. The Nicola Coal & Coke Co. own over 5 square miles of coal lands, and are directly on the proposed line of railway being built from Spence's Bridge to Nicola Lake.

A copper smelting plant is to be established at Wentworth Centre, N.S., at a cost of $300,000, according to a telegraphic report. There are several copper properties in Nova Scotia, and the establishment of the smelter should result in an increased production.

The Hanover Portland Cement Co.'s works are being remodelled and the output increased from 150 barrels a day to about 400 barrels. The plant is driven by electric power generated from water power at the company's own power plant on the Saugeen River.

A company is being formed at Godcrich to generate power for industrial purposes. It is proposed to dam the Maitland River and to construct auxiliary reservoirs to provide for the Summer drought. Cheap power would be assured for many manufacturing purposes.

The Lake Superior Company has recently made contracts with the Canadian Pacific Railway Company for 60,000 tons of steel rails, deliverable next year. The capacity of the Lake Superior Company for rolling steel rails is now fully taken up until about December 1, 1906.

The Smart-Turner Machine Co., Limited, Hamilton, have installed their duplex pump in the plants of Lumsden Bros., the Pure Milk Corporation, Andrew Langton, Brampton, Ont., John Harrison & Sons Co., A. Davis & Sons, Kingston, Northumberland Paper Electric Co.

East & Co., Toronto, are having a complete heating and ventilating system installed by Sheldon & Sheldon, Galt, Ont. So also are the following firms: London Machine Tool Co., Otis-Fensom Elevator Co., the Union Drawn Steel Co., and the Gurney-Tilden Co., all of Hamilton.

At Peterborough the factory of the Pre-Payment Meter Co. has been installed with the necessary machinery for the manufacture on a somewhat extensive scale of these meters. The work done in this plant will be an additional boom to the manufacturing interests of Peterborough.

The plan of the United States Steel Corporation to erect a plant in Canada has been shelved, notwithstanding reports that the question had again been taken up for consideration. The Pittsburg Dispatch says there is not any possibility of the scheme being gone on with this year.

The Maritime Coal & Railway Company have decided to establish an electric power plant at their mine, eight miles from Amherst, N.S., and an agreement has been entered into giving them the right to bring the power to Amherst and dispose of it for factory purposes there.

Western Canada is speculating on the probable move to be made by James J. Hill, the Canadian who has become a railway king in the United States. Rumors are rife regarding different pro-

jects he is said to be considering to build railways into the Saskatchewan wheat districts.

In the clearing house returns for the year is given the concrete amount of increase in the financial transactions for the year. The total for the year was $88,686,740, an increase of over $14,000,000 above 1904, which in its turn showed an increase of $8,000,000 over the total of 1903.

One of the largest mining deals reported in Ontario for some time has just taken place by the transfer of a copper property some 80 miles west of Port Arthur. The mine is known as the Tip Top Copper Mine, and is owned by Col. Ray of Port Arthur and Folger Bros., of Kingston.

H. H. Collier, solicitor for the Buffalo, Niagara & Toronto Railway, says that building operations will commence early in the Spring. The proposed line will run from Niagara-on-the-Lake to Buffalo, through St. David's and Bridgeburg, with a branch to St. Catharines and Welland.

By-laws to raise $20,000 for improvements for waterworks, $14,000 for electric light, and $12,000 for telephone improvements, and to give Whalen & Bowman exemption from taxes to build a marine drydock and machine shop, were carried at Fort William on January 1 by large majorities.

During the twenty-one months the Dominion Iron & Steel Co.'s blast furnace No. 4 has been in operation, 143,650 tons of pig iron, or an average of 7,000 tons per month, has been produced. On the production of this one furnace the Government has paid the bounty, amounting to $223,000.

The Farrar Transportation Company at Collingwood have decided to build a 9,000-ton steel carrier for use on the Upper Lakes. The work will be done at the Collingwood ship yards, and the boat will be completed in the Spring of 1907. It will be one of the largest Canadian vessels on fresh water.

The Temiskaming & Northern Ontario Railway Company has virtually decided to dispose of surplus electrical energy along the first 120 miles of the road, to companies along the route. The railway will deal with companies rather than with individuals or municipalities, thus obviating the necessity of keeping many accounts.

The White Sewing Machine Company, with headquarters at Cleveland, Ohio, are negotiating with the town of Welland for a site where they propose to establish a manufacturing plant in Canada. If the deal goes through they will secure certain advantages from the town and in return will employ 300 workmen.

H. W. Petrie, Toronto, has now under way the taking of a photograph of every machine in stock. This is intended as an aid to the selling department, as intending purchasers can be supplied with an original photo of any machine as required. This enterprising move will no doubt meet with the approval of the firm's customers.

A number of employes of the N. Thompson Engineering Works have won a case against the assignee, whom they sued for wages for work done after the assignment, and done at the instance of the assignee. The case turned on the adoption by the creditors of a resolution approving the action of the assignee in keeping the men at work.

The Dominion Iron and Steel Company has secured a second contract for rails from the G.T.R., aggregating 37,000 tons. Delivery on the new contract will begin the first of the year, when the I.C.R.'s 25,000-ton order will be completed. It is also said that the steel company has secured a large order for rails from the C.P.R.

Automatic feed pumps have recently been installed by the Smart-Turner Machine Co., Limited, Hamilton, in the new works of H. K. Wampole & Co., Perth, also Pennington & Bryan, Windsor, as well as a full equipment of pumps ordered by the Canada Glue Co., Brantford, who are putting up one of the most up-to-date glue factories in America.

Boynton & Plummer, Worcester, Mass., U.S.A., manufacturers of drilling machines, shaping machines, portable forges, bolt cutting machinery, etc., have moved from 52 Lagrange street to No. 54 Hermon street, Worcester, where they have more commodious quarters and better facilities for conducting their increasing business. This firm has a large and growing export trade.

The Rothschilds have taken a trial shipment of Cobalt ore for their smelters in England. They are considered the largest smelters of precious metals in the world and their purchasing of Cobalt ore should mean much to that camp. The Government is considering the advisability of erecting sampling works at Cobalt, for the convenience of miners.

The McLaughlin boiler shop, St. John, N.B., has been reopened, after several years' idleness. It has been leased to Alex. Wilson, mechanical engineer, and James O'Donnell, boiler maker, who have the sub-contract for supplying the iron work for the I.C.R. A company will be formed and about 50 men given employment in building boilers and in a machine shop to be established.

The suggestion that the Government should nationalize the harbors of Fort William, Port Arthur, Port Colborne, Kingston, Montreal, Quebec, St. John, Halifax, Sydney, Vancouver, and the Pacific coast outlets of the Grand Trunk Pacific and the Canadian Northern gives definite form to ideas that have been in the minds of many practical men who are interested in commercial and industrial expansion.

Allis-Chalmers-Bullock, Limited, Montreal, have made contracts for the electrical equipment of the Keewatin Flour Mills Co., Keewatin, the Ogilvie Flour Mills Co., Fort William, and the Western Canada Flour Mills Co., St. Boniface, Man., aggregating 4,000 horsepower. The motors range from 500 horse-power downwards. The entire equipments are under construction at the shops in Montreal.

The Economical Manufacturing & Supply Co., Limited, 173 Queen street east, Toronto, manufacturers of the well known Canada graphite, have about completed alterations to their premises, giving them additional room. This firm has recently been appointed Canadian agents for the products made by the New York Belting & Packing Co., Limited, New York, whose name is a household word among the engineers.

Two important announcements were made by representatives of the Lake Superior Corporation before the Tariff Commission at its recent sitting at the "Soo." One was that a coke plant would be built to supply the coke for use in connection with the steel plant, and the other that the directors had authorized the construction of open-hearth blast furnaces for the manufacture of steel for rails and structural purposes.

A society was organized recently at Galt by A. R. Goldie, of the Goldie & McCulloch Company, with a membership of 50 active men, the object being the beautifying of the town. Planting of trees, flower beds, vines, etc., will be particularly encouraged, besides the making of lawns, hedges and boulevards. The guild is not intended to be confined to Goldie & McCulloch men, but all citizens interested in making Galt homes and town prettier are invited to join.

A conspicuous departure in the lighting of canals is that of the Welland canal near St. Catharines, Ontario. Over 600 A.C. series arc lamps have been provided by the Canadian Westinghouse Company and these have been in operation for the past few months and have given splendid service. This installation as a whole redounds great credit to the Ontario Government, as well as to the consulting engineer, Mr. R. J. Parker, under whose direction the complete plant was installed.

The Ingersoll-Rand Company announce that they have secured exclusive control of the product of the Imperial Pneumatic Tool Company, with shops at Athens, Pa. The line of Imperial tools is well known and complete, including pneumatic hammers, drills, riveters, reamers, hoists and plug drills. The Ingersoll-Rand Company are manufacturers also of the Haeseler pneumatic tools and the public is now offered the choice of these two distinct lines of tools of established merit.

Grand Trunk Railway engineers are at Port Huron preparing the ground for the power house to be used in furnishing electric power for the tunnel. The building will have a frontage of nearly 200 feet and will extend back 300 feet. All of the cables leading to the tunnel will run down the shaft which was sunk over the property when the tunnel was constructed. The work of building the machinery has been begun by the Westinghouse Company, and will be ready as soon as the necessary building is erected.

Special machinery being added to the works of various companies recently by the Smart-Turner Machine Co., Limited, Hamilton, includes a hand-power traveling crane for the Forwell Foundry Co., Berlin, an automatic receiver to be placed in the plant of the Sudbury Building Supply Co., an independent jet condenser for the new works of the Jenckes Machine Co., St. Catharines, a brewers' air pump for Grant's Spring Brewing Co., and a tumbling barrel for the new and up-to-date plant of the Ingersoll Nut Co.

There is every indication of the reawakening of the mining industry in the northwestern portion of Ontario. The

Northern Development Co., for example, which has quietly been doing hand work for several years in the Rainy River district, is now preparing to operate on an extensive scale. They recently purchased from Allis-Chalmers-Bullock, Limited, Montreal, a complete mining plant including boilers, air compressors, rock drills, hoisting engine, pump and a large quantity of miscellaneous mining equipment.

Free Souvenir.

Readers of Canadian Machinery will be presented with a small barometer, mounted on a card, by the Berlin Electric Manufacturing Co., Berlin, Ont., by sending their name on a post card and mentioning this paper. This makes a useful article and is free to every reader.

Fiftieth Anniversary.

In commemoration of fifty years of successful business career, the J. C. McLaren Belting Co. are sending out an attractive paper weight representing a pile of ten gold pieces (twenty dollar size). In Canada but few firms have celebrated a golden anniversary, and the fact of this firm having reached the half century mark at once places it in a class as pioneers of Canadian industry.

Smith's Falls New Foundry.

Smith's Falls is to have a new iron stove foundry, which will be erected next Summer. The promoters of this new industry are Mayor Foster, Dr. Gray and John McEwen, all well-known business and financial men in town. A joint-stock company, with a paid-up capital of $30,000 is being organized. The building will cost $15,000, and will be modern in every respect. All kinds of stoves will be manufactured, and it is proposed to start with a staff of from 20 to 25 moulders.

Canada Chemical Co. Extending.

The Canada Chemical Co., of London, have undertaken important extensions in their works, included in which is the building of a large new chemical plant. Building operations will be started early in the Summer. The company has recently secured some valuable mining properties, and it is for the purpose of utilizing their ores that the acid works will be operated. The proposed location is in a Central Ontario point, north-east of Toronto, which will be convenient to the source of ore supply. Sulphuric acid and similar acids and chemicals will be produced by the most recent and advantageous patent processes. In addition to the new acid works, it is understood the company will continue to operate the present plant in London, and their distributing warehouses at Toronto and other points.

A New Electrical Industry.

A plant of considerable importance to the Canadian manufacturing trade has been opened up in Berlin, Ont., by the Berlin Electrical Manufacturing Co. for the purpose of manufacturing high grade dry cells, flash light and novelty batteries, the trade name of these being "Best." An expert has been secured who has had nine years' experience in the dry cell business, having been connected with the largest dry battery manufacturers in America. A new system in the manufacture of dry cells has been adopted whereby they have been enabled to turn out a dry cell of absolute uniformity. Their improvement increases the life of the batteries, which are guaranteed not to deteriorate more than 15 per cent. in one year on the shelves, the purest chemicals and filtered water being used.

The standard size No. 6 battery, 2½ by 6 inches, will give 22 to 25 amperes at 1.6 volts and will melt a 10-ampere fuse on a short circuit in less than 30 seconds. The larger No. 7 battery, 3 by 7 inches, shows 30 amperes and is particularly adapted for ignition purposes. Although on the market but a short time the "Best" batteries have met with a good reception and have many friends.

New Works, Armstrong Bros. Tool Co., Chicago.

The accompanying engraving gives a capital exterior view of the new plant of Armstrong Bros. Tool Co., Chicago. The site is an excellent one, the ground having a frontage of 200 feet on the Chicago & Northwestern Railway and 216 feet on Francisco Ave., corner of Carroll Ave. The main building is three storeys and basement in height and is of standard mill construction with stairways and elevators enclosed in brick shafts fitted with fireproof automatic closing doors.

Armstrong Bros'. Tool Works.

The dimensions of the main building are 175 x 60 feet, with one storey annex 175 x 30 fe t. The location and arrangement of the buildings is such that perfect light and ventilation is secured. Much new machinery of the latest type has been installed. Steel pulleys with pressed steel hangers and roller bearings are used exclusively. Iron and sheet steel are used wherever possible in partitions, benches, stands, drawers, packing tables, stock racks, and shelving, very little light wood being visible.

The assembling, stock and shipping departments are especially remarkable in this respect and comprise one of the most complete and well designed sheet steel fixture installations in the United States.

We hope later on to show some interior views of this plant, which will prove of general interest.

Robb Engineering Co's Growth.

At Amherst, during the first week in January, the Robb Engineering Company entertained at dinner, at the Terrace Hotel, their travelers, representatives, foremen and superintendents of departments. President D. W. Robb presided, and at length he outlined the origin and progress of the company. Among those present were Mr. J. F. Porter, of Winnipeg, and Mr. Wm. McKay, of Toronto. One of the pleasant events of the evening was the presentation to D. W. Robb of a handsome clock and candelabra by the members of the selling staff. Mr. Robb, in referring to the company's history, said that on May 9, 1865, over forty years ago, the first sod was turned for the erection of a small foundry, which has since grown into the works of the Robb Engineering Company. The original site consisted of two acres, and the first building to be erected was the foundry, 30 x 60 feet, with a monitor roof. In addition a small machine shop, about 30 feet square, with engine and boiler house in the rear, was built. The first engine and boiler used for the machine shop was about 15 horse-power. Since then the growth of the company has been marvelous. New and extensive works have been established at Amherst and at Framingham, Mass., and branches opened at Montreal, Toronto and Winnipeg.

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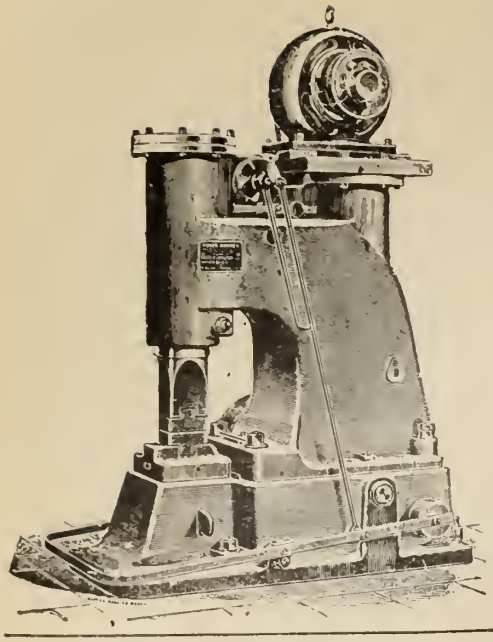
An Important Centre.

When the Tariff Commission was in session at Amherst, N.S., the members were addressed by D. W. Robb, president of the Robb Engineering Company, and vice-president for Nova Scotia of the Canadian Manufacturers' Association. He spoke of Amherst as one of the best examples in Canada of what prosperous factories can do for any locality. He pointed out that the business passing through Amherst station exceeds that at any point on the line except Montreal, St. John and Sydney, and if the Commission could be instrumental in developing business over the whole Intercolonial in like proportion, the question of its deficits would be solved. He claimed that the protection



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and inducement of a reasonably protective tariff are a great incentive to investment in industries, and a strongly protective tariff would encourage larger investments in Nova Scotian industries. Expressing his personal views, he emphasized the fact that the present 25 per cent. duty had not prevented manufacturers of other countries, especially the United States, from sending nearly half a million dollars' worth of engines and boilers into Canada yearly for the last three or four years. He considered the recommendation of the Canadian Manufacturers' Association for increasing the duty on engines and machinery of that class to 35 per cent. in the interest of the whole country.

At the sitting of the Tariff Commission at Three Rivers recently, Mr. G. R. Duncan, manager of the Montreal Pipe Foundry, pleaded for an increased duty on iron pipes. He maintained that Scotch and English pipe could be put down in Canada at such rates as to cripple the industry in Canada, the reason being that they had advantages in the matter of pig iron, wages, freight rates, and fuel. In the matter of wages, he contended that in Canada we pay the American rates. Men in their works received $1.75 to $2.25 per day, while the same class can be had in Britain for $1.35 to $1.50 per day. Instead of $5.35 per ton, Mr. Duncan pleaded for a minimum of duty of $8, the cost of a ton of pipe in England being $22. Mr. Gelineas, manufacturer of chains and snow shovels, and Mr. O. Carignan, manufacturer of paints from Canadian ores, pleaded for increased protection in their respective trades.

PRACTICAL MECHANICS.

By W. H. Raeburn.

(*Continued from page 57*)

which enters so largely into the construction of machines of various kinds. We shall endeavor to make clear the methods of making calculations for speeds and loads of gears in our next article. We cannot, however, pass to that branch of the subject without making a few observations regarding bent levers.

A Mistaken Idea.

Some years ago an English bicycle manufacturer put on the market a crank as shown in Figure 3, which is a striking illustration of the fact that even reputable mechanics betray at times a lack of knowledge in elementary principles. The idea was to get the same effect as an 8-inch crank would produce, yet with the motion of a 6½-inch crank. A short examination in the light of the principle of moments will show the fallacy of such hopes. Let a pressure of 50 lbs. be exerted at (P), then the moment of that force about the centre of motion is clearly $50 \times 6\frac{1}{2} = 325$ in. lbs., the distance 6½ in. being measured at right angles to the line of direction of the pressure. By no means can we exert pressure at (P) so as to make the distance from the line along which the pressure acts to the centre of the axle greater than 6½ in., so that the peculiar style of the crank is of no avail so far as increasing leverage is concerned. When using a wrench we unconsciously carry out the idea suggested here. We apply the force at the greatest possible distance from the fulcrum, and at right angles to the lever, thus exerting the maximum turning moment.

CONTENTS

Modern Canadian Manufacturing Plants 45
Article XII. Large Wood-Working Establishment of Jas. Davidson, Ottawa.

The Nicholson File Corporation.... 49

Editorial 50
The Wood-Working Machinery Outlook.
Granted Special Privileges.
Quality Rather than Quantity.
Producing Steel Thermo-Electrically.
Editorial Notes.

Natural Selection Applied to Industrial Arts 54
By Egerton R. Case.

Improvement of the Steam Boiler... 55
By Peter Bain.

Designing a Wood-working Molder... 56
By T. C. Robertson.

Practical Mechanics 57
Article IV. By W. H. Raeburn.

An Innovation in Type-Composing Machines 58

Practical Questions and Answers.. 60

Reviews of the Month 61
Methods for Cutting Different Woods.
Burning Sawdust.
How to Turn a Hollow Ball.
Static Electricity in Ore Separation.

Book Reviews 64

Construction and Improvement..... 65
The Concrete Column Coming.
Lightning and Modern Structures.

Steel Stacks for Mills. 66
By F. C. D. Wilkes, B.Sc.

Machine Shop Costs 68
By C. G. Keith.

Personal Mention 69

Power and Transmission 70
Construction of New High Pressure Blower.
Westinghouse Air Pump.
New Power House.

About Catalogues. 75

Machinery Development 76
Lathe Attachment for Boring.
Railroad and Manufacturing Shaper.
MacGregor-Gourlay Molder.
Manufacturers' Gang Drill.
Heavy Wood-Working Machines.
New Bliss Multiple Punch Press.
British Power Hammers.

Companies Incorporated 81

Industrial Progress 82

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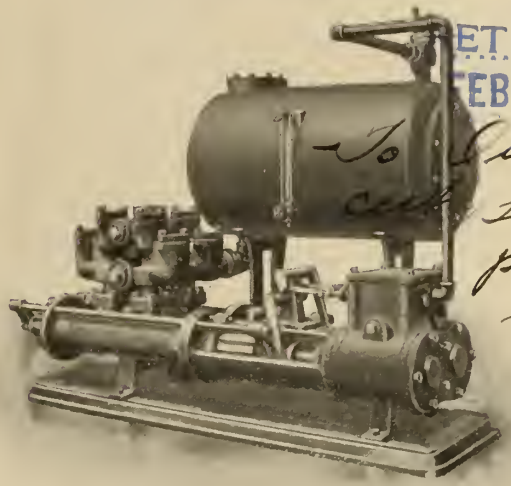

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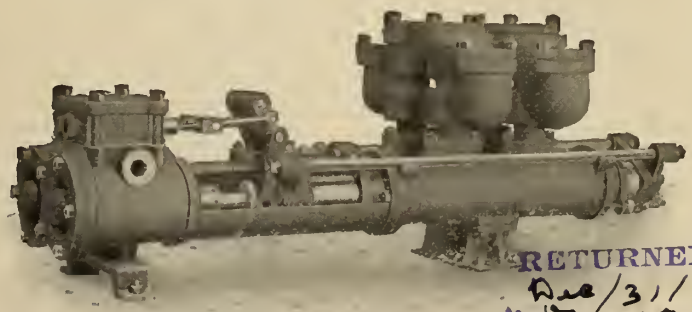

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Readers of CANADIAN MACHINERY are invited to use this directory as a ready reference when seeking to buy any machinery or machinists' supplies. In it will be found a list of goods made by leading Canadian firms and by the principal firms in other countries who are devoting especial attention to the Canadian market. It is the intention of the publishers of this paper to issue a desk index for machinery buyers, and all advertisers are invited to send in full list of lines manufactured.

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National Machinery Co., Tiffin, Ohio.
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Smart-Turner Machine Co., Hamilton.
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Castings, Steel
Ottawa Steel Castings Co., Ottawa.

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Chucks, Planer.
American Tool Works Co., Cincinnati.
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D'Olier Engineering Co., New York.
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Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
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The Dodge Mfg. Co., Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Link-Belt Eng. Co., Philadelphia.
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Ottawa Steel Castings Co., Ottawa.
Waterous Engine Works Co., Brantford.
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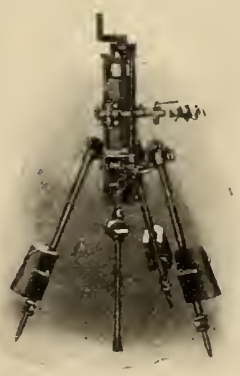

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ALPHABETICAL INDEX.

A

Abbott, Wm. ... 69
Allis-Chalmers-Bullock Co. ... Outside back cover
American Tool Works Co ... 3
Armstrong Bros. Tool Co ... 76

B

Barnes, B. F., Co ... 7
Banfield, W. H., & Sons ... 67
Becker-Brainard Milling Machine Co. ... 2
Berlin Electrical Mfg. Co ... 59
Bertram, John & Sons ... 2
Bickford Drill & Tool Co ... 6
Bliss, E. W., Co ... 7
Boynton & Plummer ... 67
Brandeis, Charles ... 63
Brown & Sharpe Mfg. Co ... 75
Budden, Hanbury A. ... 63
Butterfield & Co ... 70

C

Canada Foundry Co. ... 59
Canada Machinery Agency ... 10
Canada Pneumatic Tool Co ... 74
Canadian Press Clipping Bureau ... 63
Canada Chemical Mfg. Co ... 13
Canadian Co-Operative Co ... 65
Canadian Fairbanks Co ... 15, 16
Canadian Rand Drill Co. ... 78
Canadian Westinghouse Co ... 1
Canadian White Co ... 77
Carr, John ... 61
Carter Publishing Co ... 67
Chadwick Bros ... 69
Chapman Ball-Bearing Co ... 9
Cincinnati Shaper Co ... 7
Clark-Demill Co ... 13

D

David, R. Sullivan ... 77
DeCew, J. A ... 67
Diamond Saw and Stamping Works ... 74
Dodge Mfg. Co ... 8
D'Olier Engineering Co ... 78
Dominion Belting Co ... 72
Dominion Rock Drill Co ... 61
Dominion Sewer Pipe Co. inside back cover

E

Eco Magneto Clock Co ... 66
Economical Mfg. and Supply Co ... 14
Engineering Specialties Co ... 14
Engineering Times ... 67
Expanded Metal and Fireproofing Co. 61

F

Fetherstonhaugh & Co ... 63
Fetherstonhaugh & Blackmore ... 63
Fielding, John S. ... 63

G

Geometric Tool Co ... 73
Globe Machine & Stamping Co ... 69
Goldie & McCulloch Co ... 1
Greening, B., Wire Co ... 68

H

Hamilton Facing Mills Co ... 66
Hamilton Pattern Works ... 61
Hare, F. E ... 69

J

Jardine, A. B., & Co ... 73
Jenckes Machine Co. ... 68
Jessop, Wm., & Sons ... 69

K

Ker & Goodwin ... 71
Krug & Crosby ... 74

L

Leonard, E., & Sons ... 66
Lewis, Rice & Son ... 75
Link-Belt Eng. Co ... 9
London Machine Tool Co. ... 5

M

McLean & Sophus ... 72
Marion & Marion ... 63
Merrell Mfg. Co ... 9
Morrow, John, Machine Screw Co. ... 73
Morton, B. K., & Co ... 69

N

National Machinery Co ... 66
New Process Twist Drill Co ... 71
Nicholson File Co ... 77
Nugent, Wm. W., & Co ... 14

O

Otis-Fensom Elevator Co. inside back cover
Ottawa Steel Castings Co ... 69

P

Packard Electric Co ... 79
Parke, Roderick J ... 63
Penberthy Injector Co ... 63
Petrie, H. W ... 11
Pratt & Whitney Co ... inside front cover
Pringle, T., & Son ... 63

R

Ridout & Maybee ... 63
Rubbra, Alfred ... 61

S

Sells Commercial ... 70
Sheldon & Sheldon ... 12
Smart-Turner Machine Co ... 59
Standard Bolt and Nut Co ... 61
Standard Tool Co ... 72
Standish, W. T ... 5
Starrett, L. S., Co ... 71
Stevens Co. of Galt ... 68
St. Lawrence Supply Co ... 70
Sturtevant, B. F., Co ... 12
Spon & Chamberlain ... 63
Sylvester Mfg. Co ... 67

T

Taylor & McKenzie ... 71
Technical Pub. Co ... 79
Toronto and Hamilton Electric Co ... 78
Toronto Plate Glass Importing Co. ... 61

U

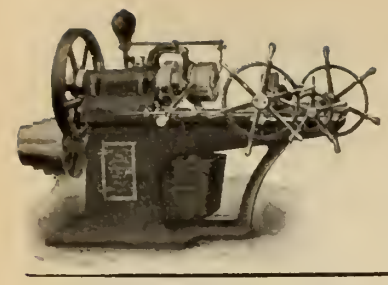
Underwood, H. B., & Co ... 7
Union Drawn Steel Co ... 68
United Electric Co. ... Inside back cover

V

Volta Electric Repair Works ... 7

W

Waterous Engine Works Co. ... 10
Wayland Williams & Dadson ... 10
West Haven Mfg. Co ... 73
Wells Pattern & Model Works ... 61
Williams & Wilson ... 4
Wilmarth & Morman ... 5



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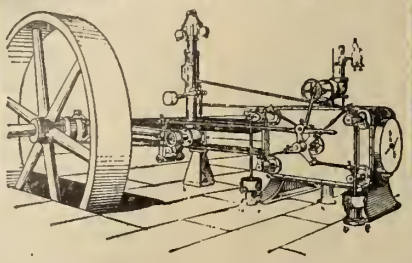

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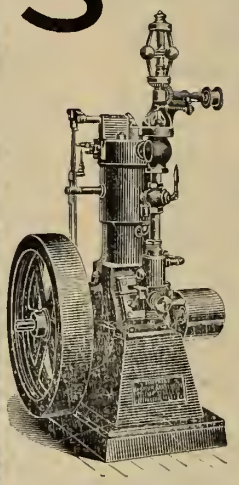

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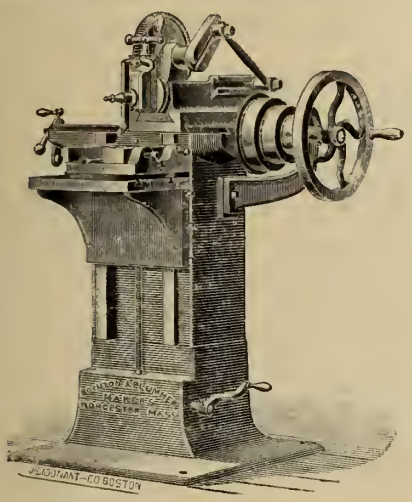

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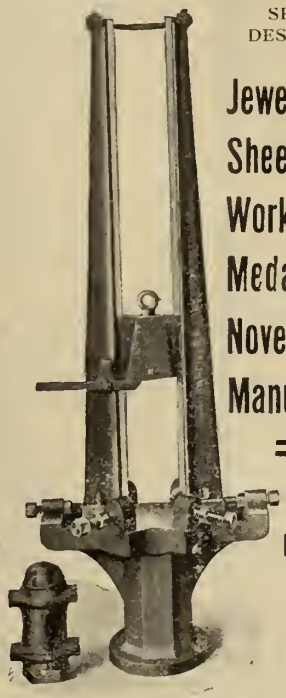

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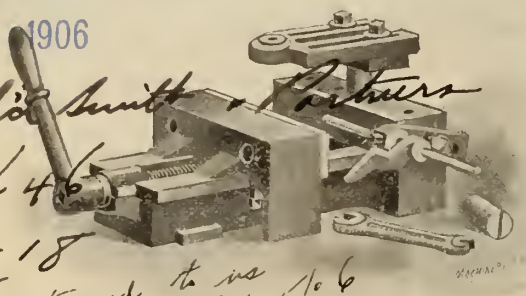

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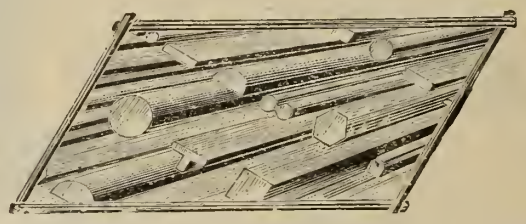

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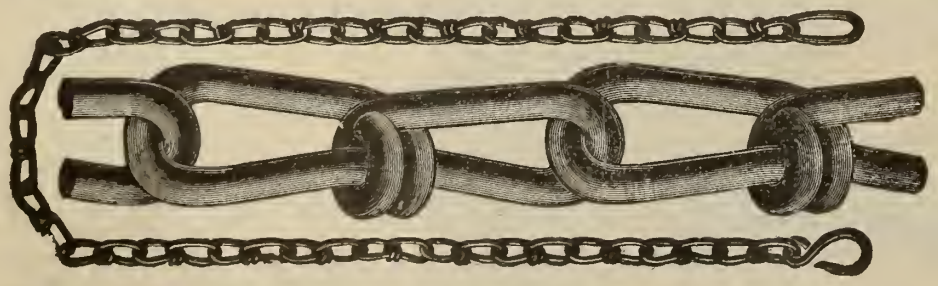

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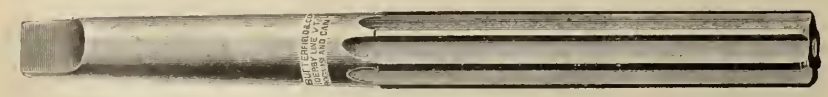

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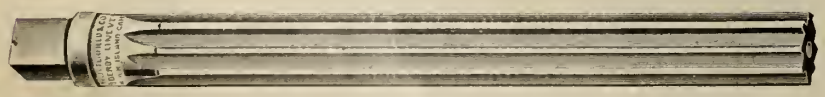

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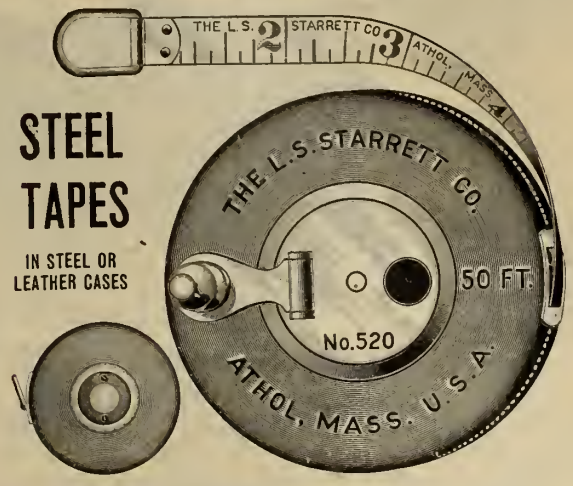

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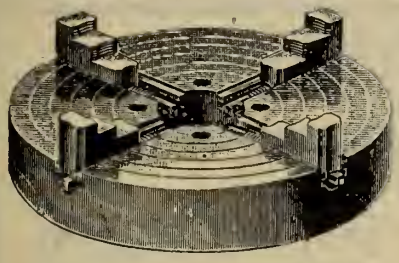

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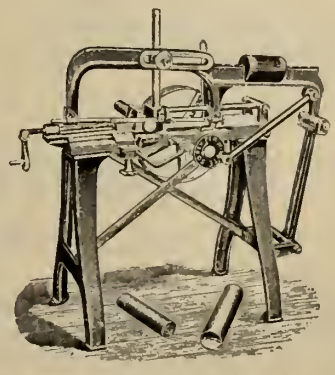

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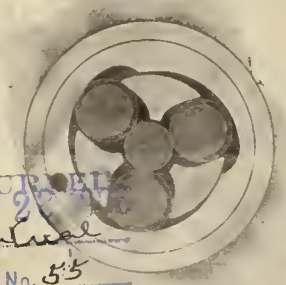

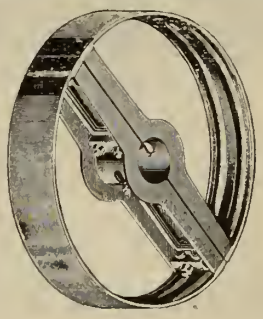

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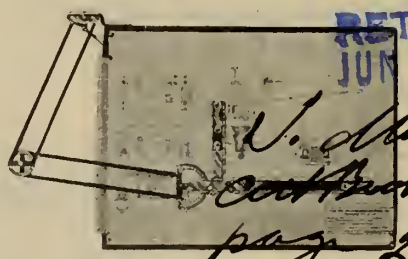

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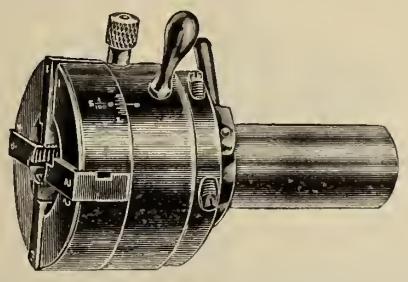

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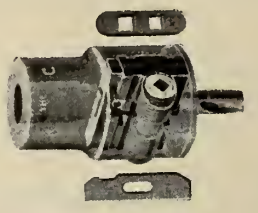

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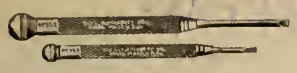

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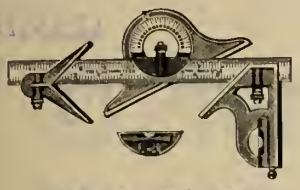

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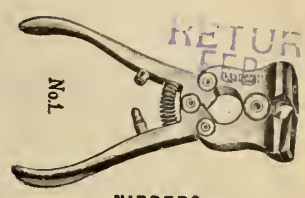

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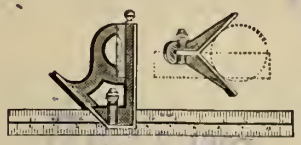

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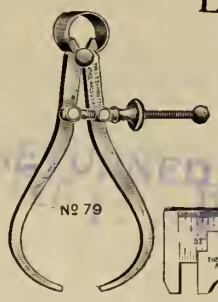

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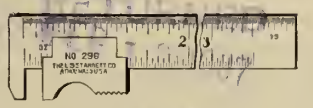

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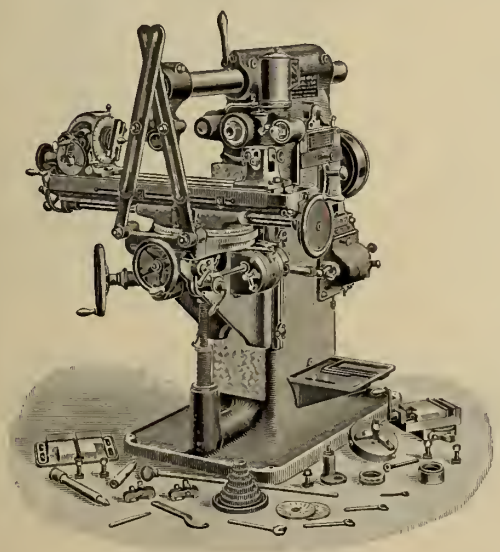

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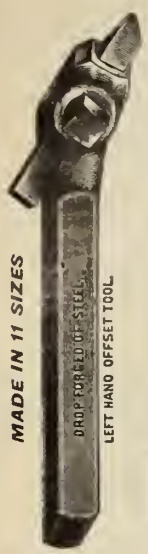

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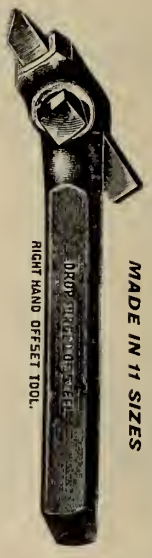

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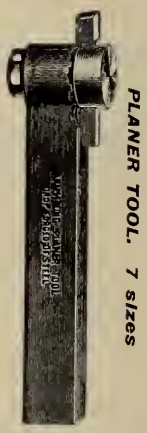

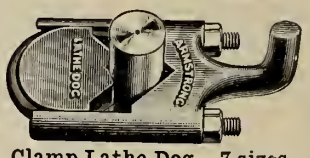

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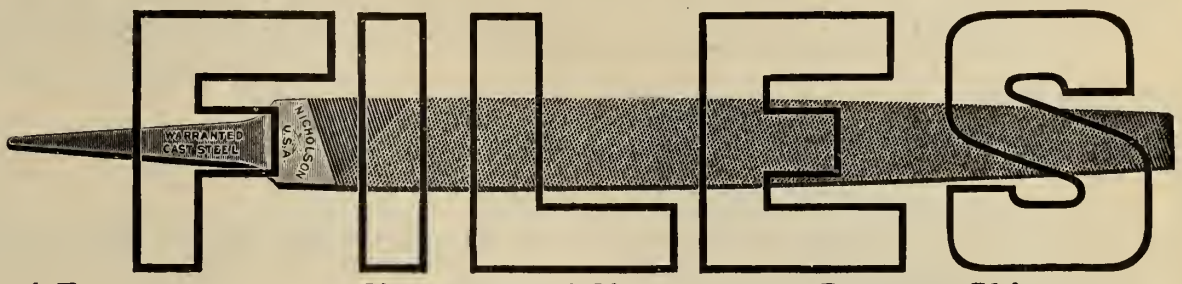

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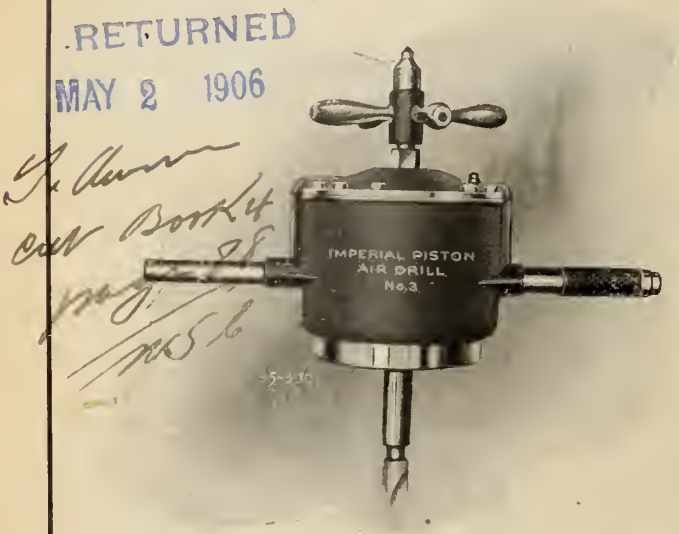

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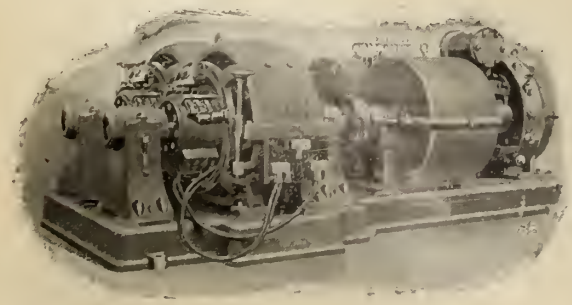

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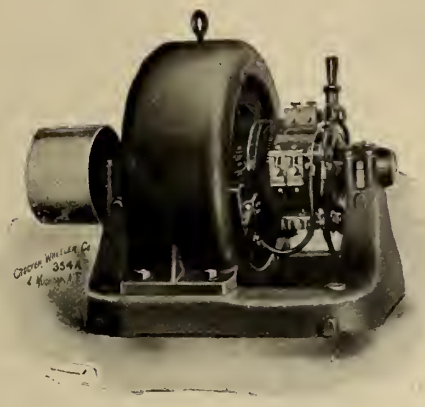

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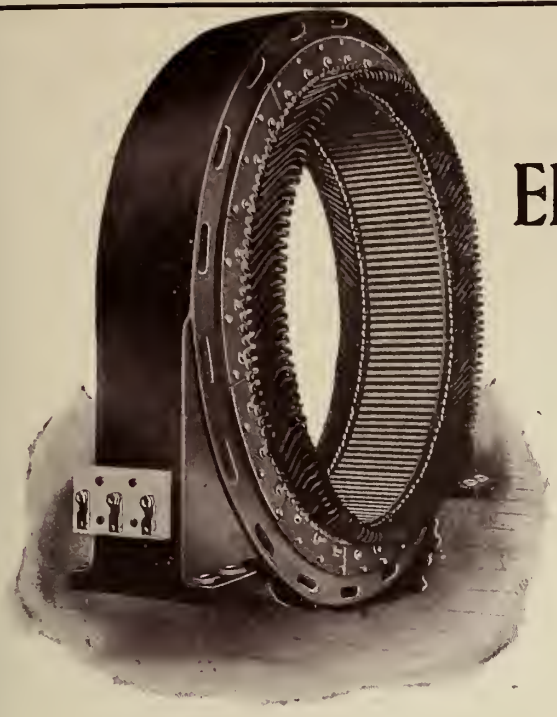

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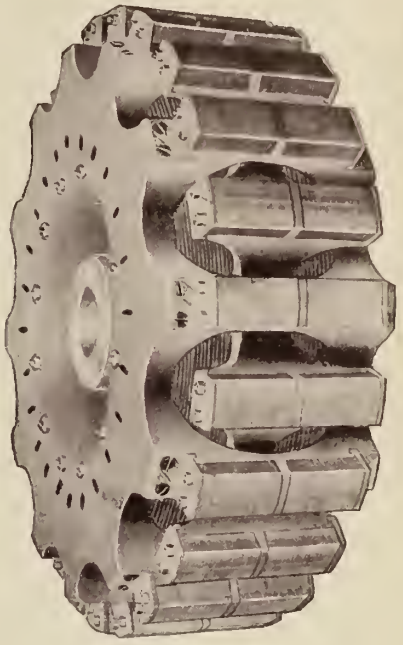

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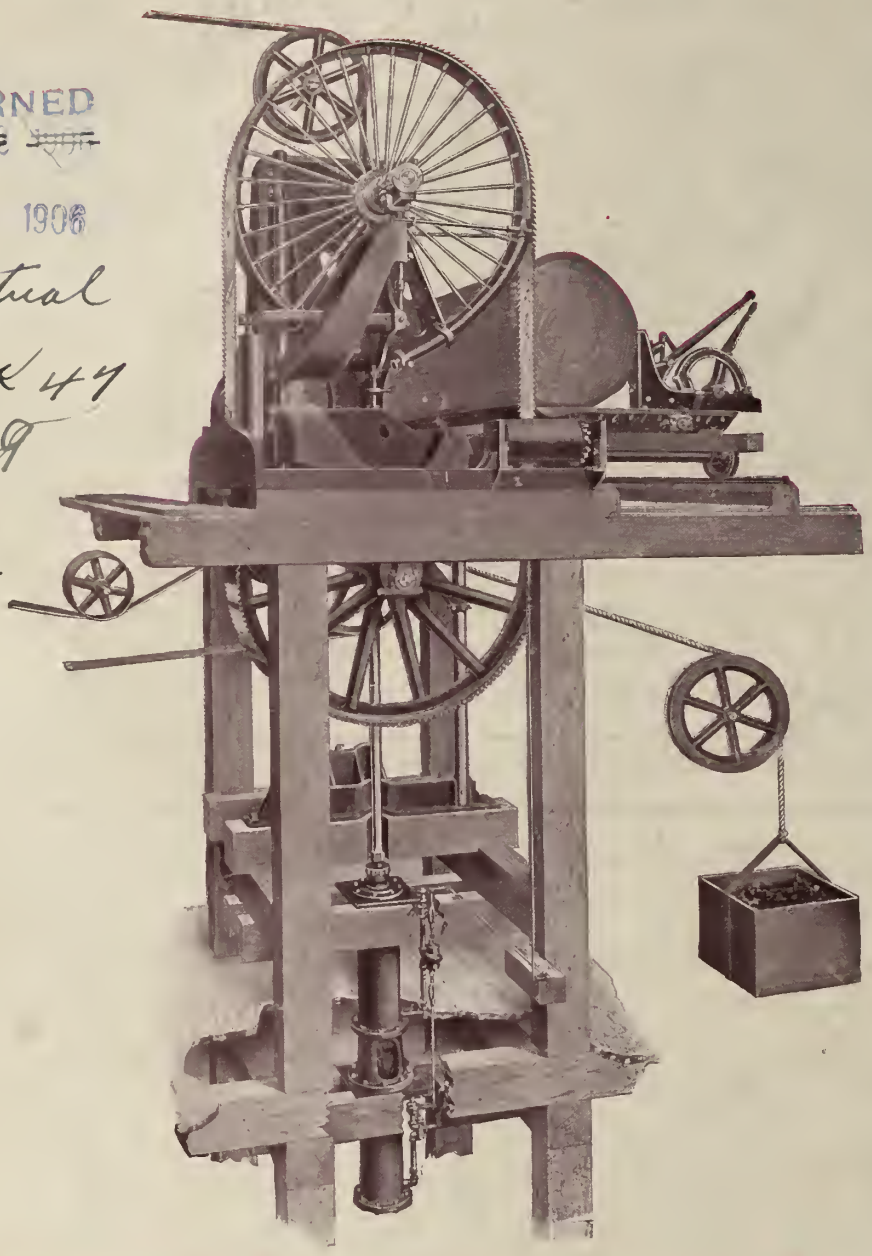

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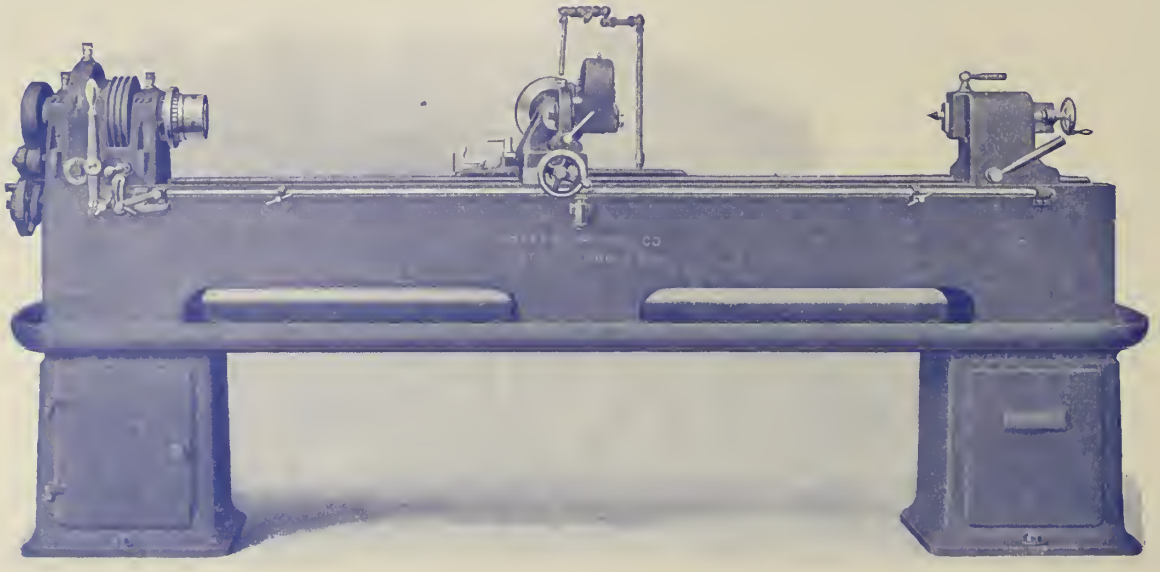

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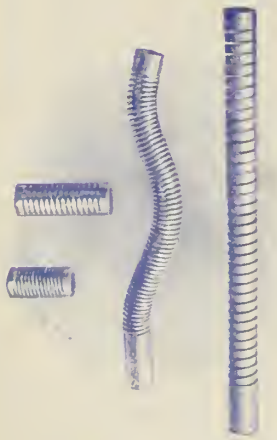

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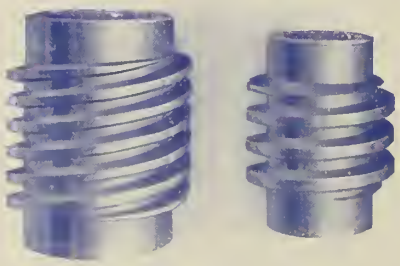

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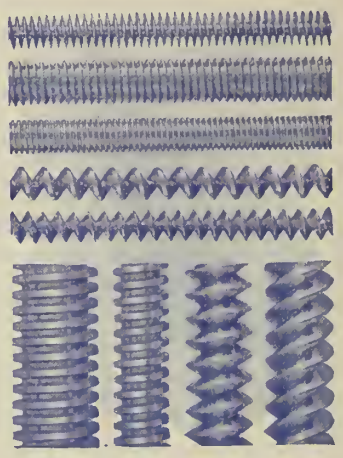

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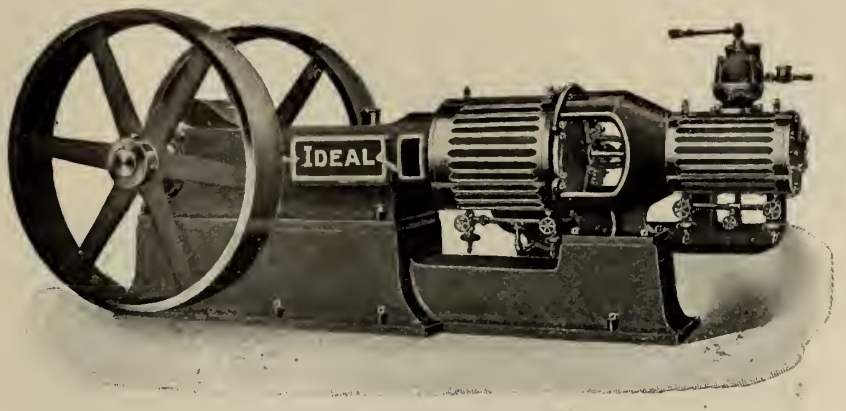

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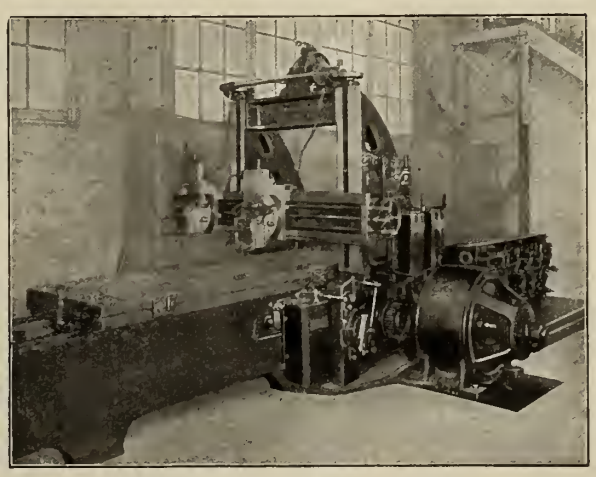

Decrease Costs

Individual drive minimizes the cost of overtime work; only the tools in actual use consume power.

Westinghouse Type S Motor Driving Planer.

Canadian Westinghouse Co., Limited

General Office and Works, HAMILTON, ONTARIO

Lawlor Bldg., King and Yonge Sts.
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DODGE Manufacturing Co.

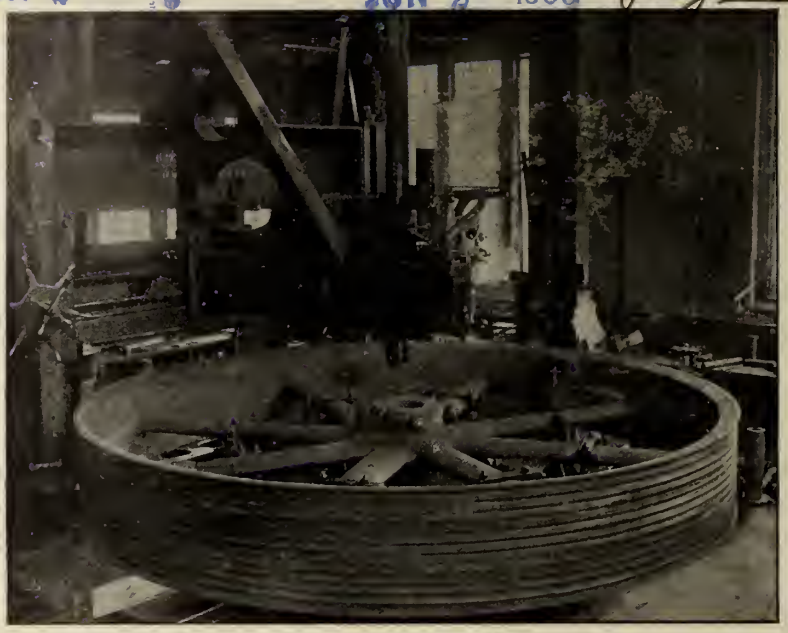
TORONTO - MONTREAL

Engineers — Founders — Machinists

RETURNED JUN 2- 1906 JUN 2- 1906

Turned Shafting
Pillow Blocks
Floor Stands
Friction Clutches
Rope Wheels
Belt Wheels
Wire Rope Sheaves
etc., etc.

Detachable Chain



We maintain an efficient Engineering Department.

Heavy Castings a specialty.

Millwrighting

We make everything for Power Transmission!

Correspondence solicited

Shafting, Hangers and Pulleys

Always in stock for immediate shipment.

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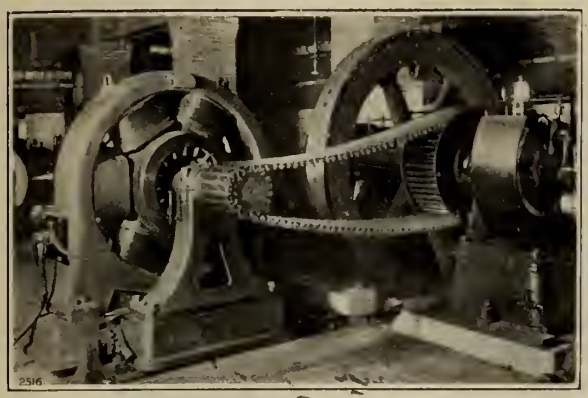
Montreal Branch House, 419 St. James St



150 H. P. motor driving air compressor at New Lasalle St. Station of Rock Island R. R., Chicago.

Renold Silent Chain

is the only bushed chain of its type in existence. ***THE PIN ROTATES,*** distributing the wear evenly at the joints—a detail that helps to make this chain the most durable as well as the most effective power transmitter yet devised.

Let us send you Booklet "J" and Bulletins 50, 52 and 58.

The Link-Belt Engineering Co.
PHILADELPHIA

NEW YORK: 49 Dey Street | PITTSBURGH: Park Building | BOSTON: 164 Federal St.

The Link-Belt Machinery Co.
CHICAGO

Merrell Motor and Engine Driven Machines

Motor Drive

These machines, which are to be had in four sizes, will do far more rapid work, both in threading and cutting off, than any other combined machine on the market. The gear enclosing the dies is completely housed from dust and chips. The rheostate is inside of the base and the starting lever in a convenient location on the side of the machine. The motor used is constant, the variation in speed of the machine being obtained by means of an idler pinion and nested gears.

Illustrated Catalogue sent on request.

THE CANADIAN FAIRBANKS CO., LIMITED

Sole agents for Canada

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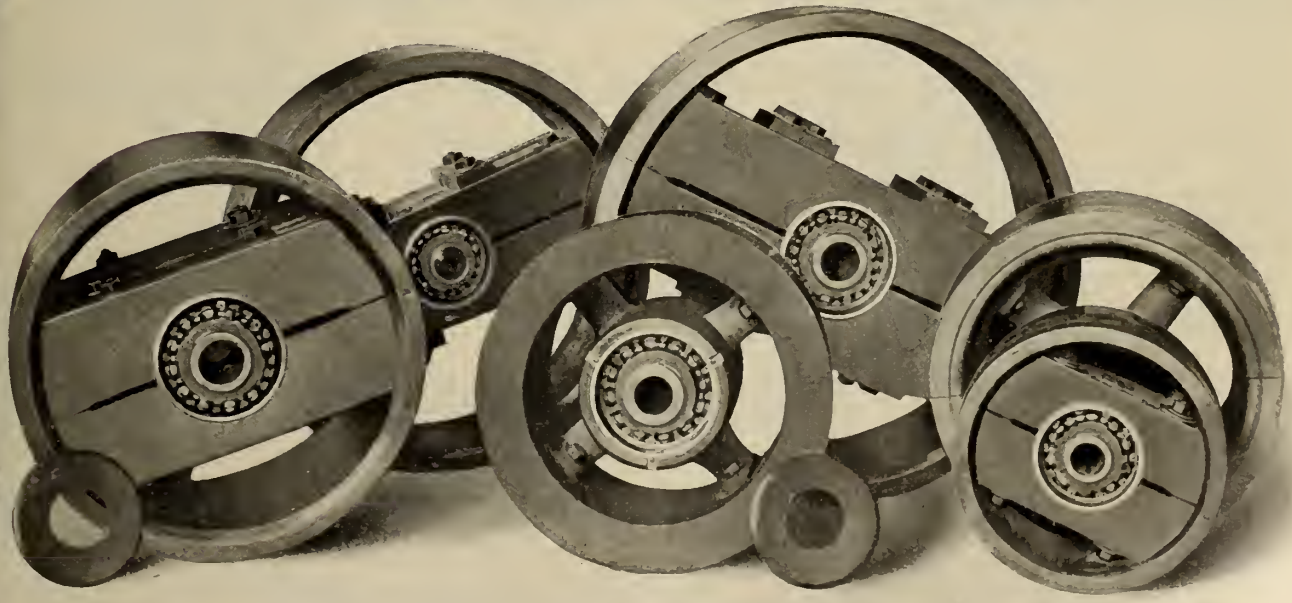
HAVING TROUBLE WITH YOUR LOOSE PULLEYS?

Chapman Double Ball Bearing Pulleys will not heat nor cut, will not ruin belting by throwing oil and are guaranteed to give satisfaction.

SPECIFY THEM IN YOUR NEXT ORDER FOR

WOOD-WORKING MACHINERY



Send for catalogues and letters from manufacturers who have them in use.

THE CHAPMAN DOUBLE BALL BEARING CO. OF CANADA, LIMITED

OFFICE—39 SCOTT STREET. FACTORY—39 PEARL STREET, TORONTO.

ALLEN'S IMPERIAL MANGANESE STEEL.
NON - MAGNETIC
TRAMWAY POINTS and CROSSINGS.--This Crossing was
BENT COLD from the Straight under a tup weighing 25 cwt.
falling over 60 times from a height of 30 feet.
ALLEN'S IMPERIAL MANGANESE STEEL
NON MAGNETIC
12"
5' 6"
SOLE MAKERS EDGAR ALLEN & CO LTD IMPERIAL STEEL WORKS. SHEFFIELD.

Edgar Allen & Co., Limited

Manufacturers of

TRAMWAY POINTS and CROSSINGS

Tramway Passing Places, Junctions, Depot Sidings, Lay Outs.

Supplied complete with all Fittings ready for laying on the road.

OVER 20 YEARS' EXPERIENCE.

Sole Makers of

ALLEN'S IMPERIAL MANGANESE STEEL

WILLIAMS & WILSON, Canadian Agents

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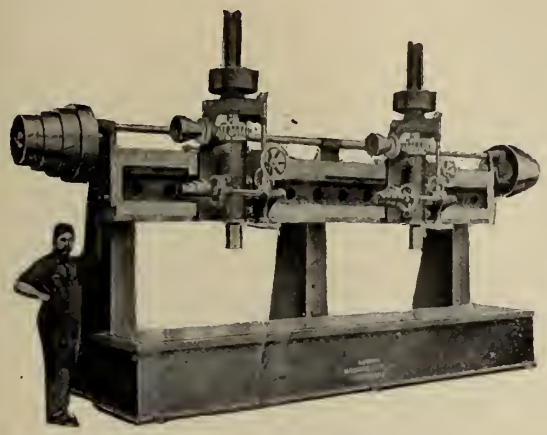
LONDON. - ONT.

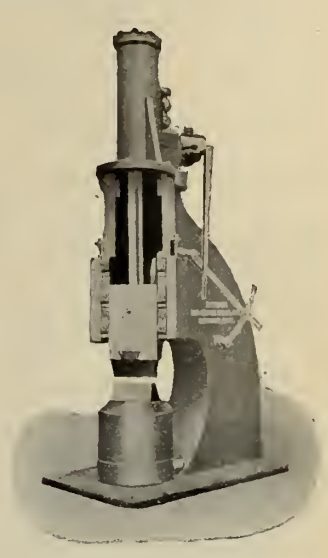
Manufacturers of HIGH-GRADE.... **MACHINE TOOLS**

Can equip our Machines for Motor Drive.



Duplex Rod Boring Machine.

**Lathes,
Planers,
Shapers,
Steam Hammers,
Drop Hammers,
Plain Drills,
Radial Drills,
Boring Mills,
Presses.**



1,000 lb. Steam Hammer.

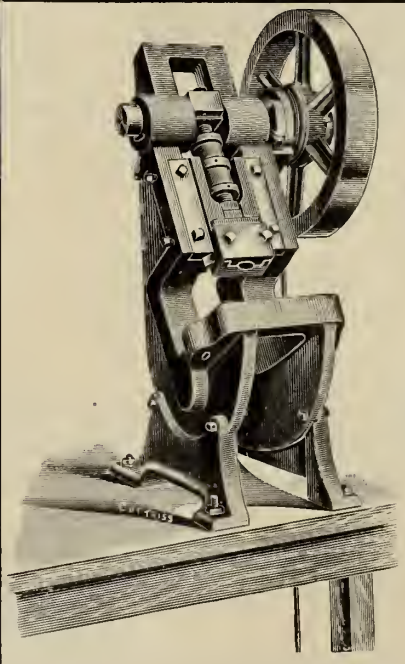
IF YOU KNEW

THE MULTITUDE OF DIFFERENT JOBS (Besides Drill Grinding)

THIS NEW YANKEE DRILL GRINDER

can be used for, you'd want one of them. Simple' quick, efficient for drills, handy, convenient and accurate for all kinds of grinding. You can't afford to grind drills by hand when a GOOD machine can be bought for a small sum. Would be glad to send catalog.

WILMARTH & MORMAN CO.,
577 Canal Street, - Grand Rapids, Mich.



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Canadian Made

ALL SIZES

For Stamping of all kinds

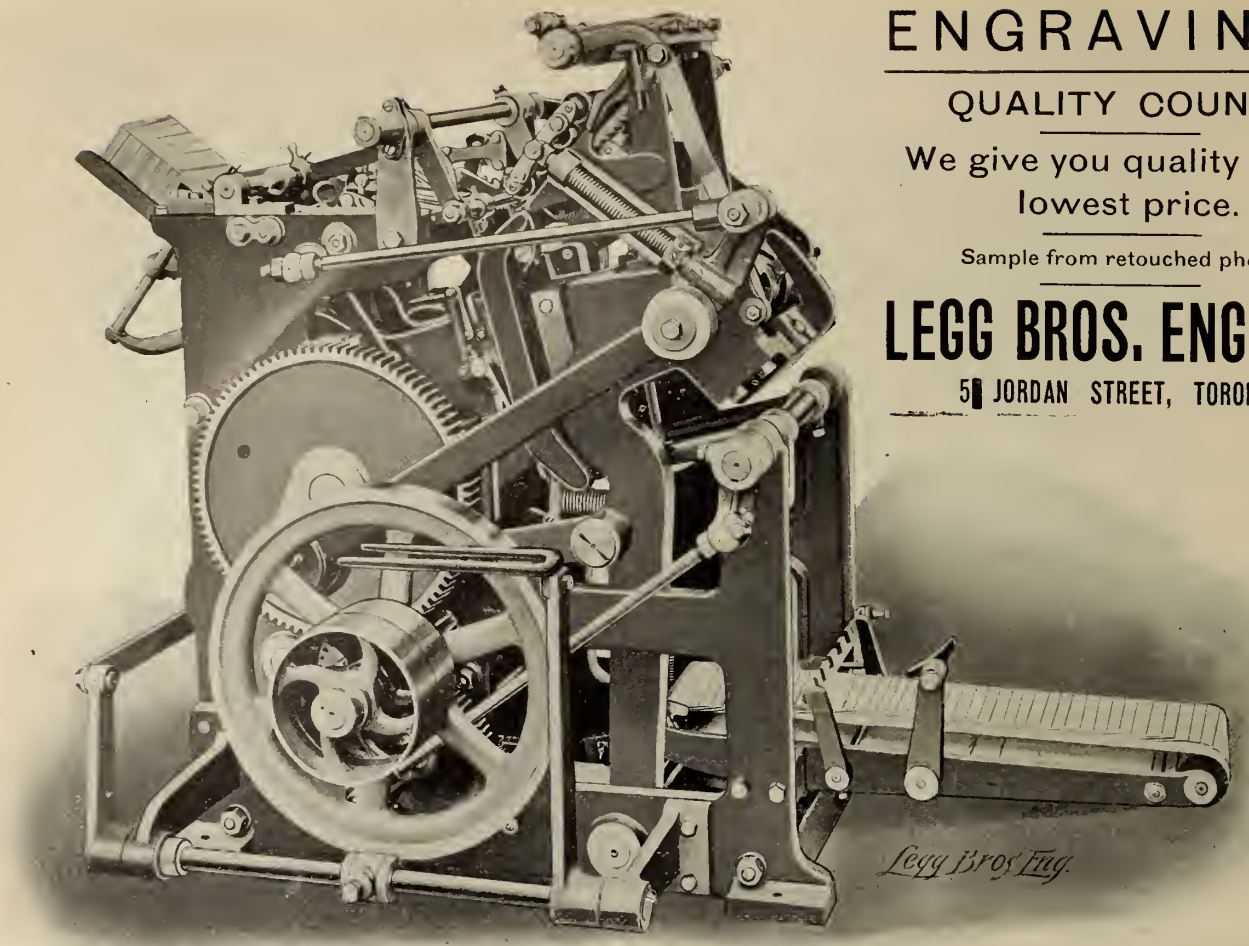
Equipped with instantaneous four-point clutch

Also Tinsmiths', Cornice Makers', Metal Workers' and Canners' Machinery.

Manufactured by

Brown, Boggs & Co., Limited

Special Representative:
W. T. STANDISH, - - Toronto



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QUALITY COUNTS

We give you quality at the lowest price.

Sample from retouched photo.

LEGG BROS. ENG. CO.,

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EVERYTHING WITHIN REACH

OUR LATEST AND BEST.
A COMBINATION OF
POWER, RIGIDITY AND
EASE OF MANIPULATION.

30″ RADIAL DRILL

The Bickford Drill & Tool Company

Cincinnati, O., U.S.A.

CANADIAN AGENTS—H. W. Petrie, Toronto, Williams and Wilson, Montreal.

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To the Canadian Machinery Trade :

We beg to announce that we have appointed as our representative for the Dominion of Canada

GEO. H HOWARD, Dundas, Ontario

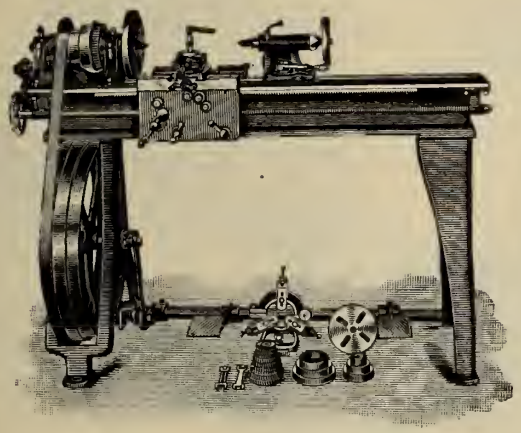
He will be pleased to place before any prospective customers full information regarding our product. Write him for literature and prices.

Cleveland Automatic Machine Co.
Cleveland, O.

Potter & Johnston Machine Co.
Pawtucket, R.I.

LOCAL OR LONG DISTANCE PHONE, 65 DUNDAS.

SCREW CUTTING LATHES



This is our 11-inch Screw Cutting Lathe, furnished in both Foot Power and Countershaft styles. Has full compound rest, power cross feed, off-set tail stock with set over adjustment for taper work, hollow spindle, etc.

We also build other sizes.

For Catalog N address

B. F. BARNES COMPANY

Ontario Agent:
H. W. PETRIE, Toronto

ROCKFORD, ILL.

Don't Throw Money Away—Be Wise

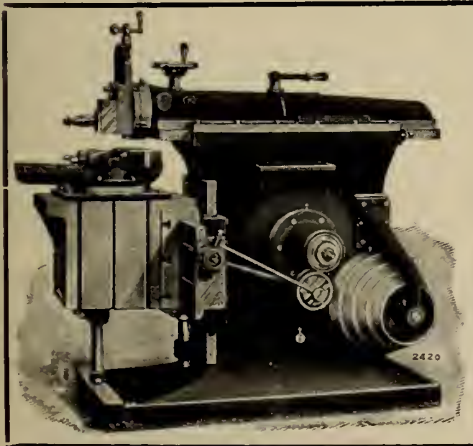
Underwood Drilling Attachment.

Look at this unique LABOR SAVER, the Underwood Lathe Attachment for Boring now being placed on the market.

Converts a Lathe into a Horizontal Boring Mill.
Increases your shop equipment at small cost.
Saves hundreds of dollars on the price of an expensively installed Boring Mill.
Equals a Boring Mill in quality and quantity of work within range.
Weight of attachment for 30-in. lathe, 685 lbs.

Made in all sizes by

H. B. UNDERWOOD & CO.
1035 Hamilton St., - Philadelphia, Pa.



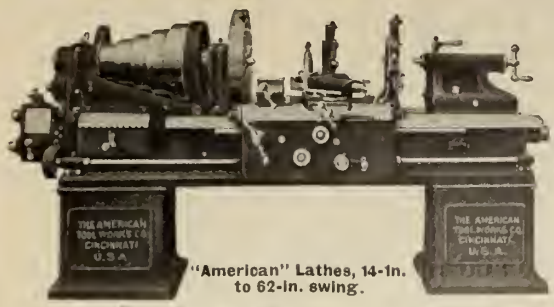
"CINCINNATI" HEAVY DUTY SHAPERS

Are built to stand the excessive strains caused by heavy cuts and big feeds with high-speed steels. All sliding bearings have taper gibs, adjustable endwise by single screws, and the crank block is drop forged. A high-gear ratio, an ample amount of cast-iron properly distributed, and high-class workmanship, combine to place the "CINCINNATI" in the front rank.
Catalog on request.

THE CINCINNATI SHAPER CO.

CINCINNATI, OHIO, U.S.A.

Canadian Agent: - H. W. PETRIE, - Toronto, Ontario

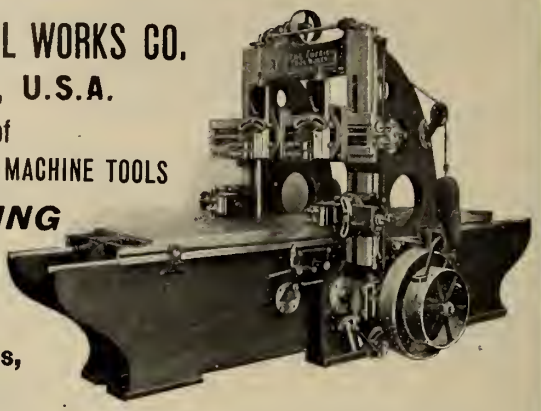


"American" Lathes, 14-in. to 62-in. swing.

The AMERICAN TOOL WORKS CO.
CINCINNATI, U.S.A.

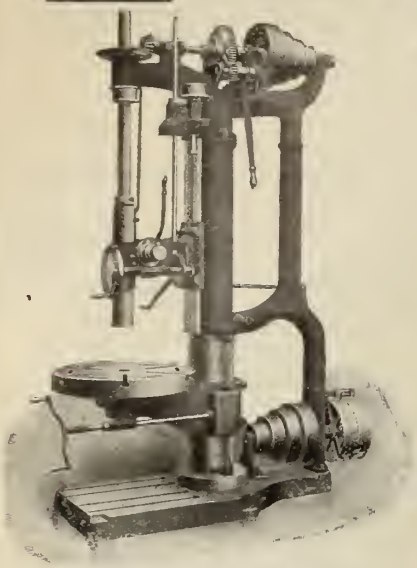
Builders of
MODERN, HIGH STANDARD MACHINE TOOLS

FOR REDUCING SHOP COST

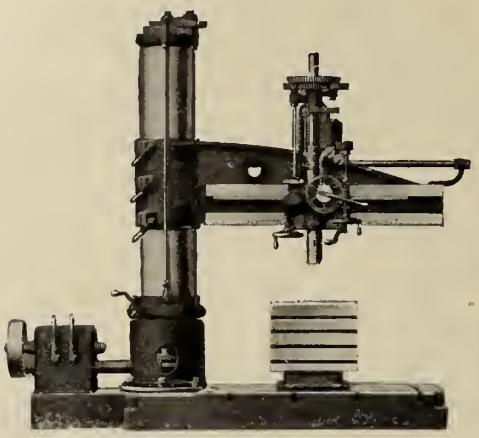


Planers, 22-in. to 72-in. between Housings.

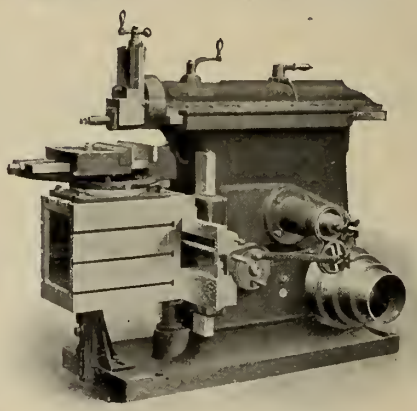
Write direct for catalog, prices, or any desired information.



Upright Drills, 13-in. to 36-in Swing.



Radial Drills, 2½-ft. to 7-ft. Arms.



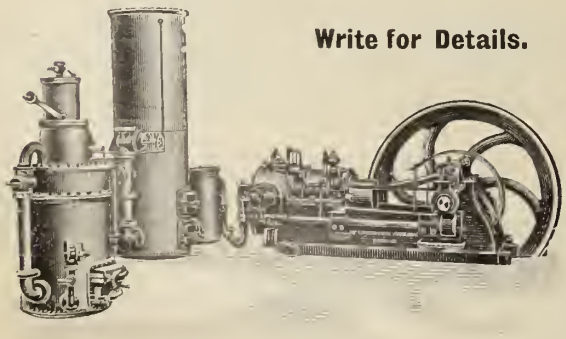
Shapers, 16-in. to 28-in. Stroke (just out).

Suction Gas Power Plants

5 to 500 H. P. Units.
Fuel Cost $8.00 per H. P. per Year.

Six of our plants in operation or under erection in Canada.

Write for Details.



Wayland Williams & Dadson
321 St. James St., MONTREAL

High Grade

MACHINE TOOLS

IN STOCK

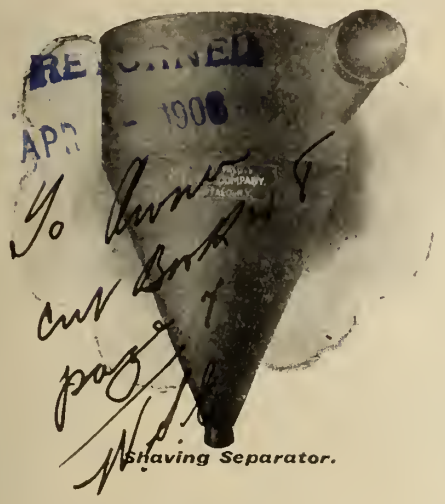
15″ x 6′ Engine Lathes
15″ x 8′ " "
18″ x 10′ " "
22″ x 12′ " "
27″ x 14′ " "
24″ x 40″ x 10′ Gap Lathes
24″ x 40″ x 20′ " "
24″ x 24″ x 6½′ Iron Planers
24″ x 30″ x 8′ " "
24″ Iron Shaper
32″ Boring Mill
20″ Drilling Machines
24″ " "

Quotations cheerfully submitted

CANADA MACHINERY AGENCY
W. H. NOLAN, Prop. **MONTREAL**

CANADIAN BUFFALO FORGE CO. LIMITED

The Experience of Twenty Years in the design and construction of Fans, make Buffalo Blowers and Exhausters unequalled for the economical handling of AIR FOR ANY PURPOSE.



Shaving Separator.

PLANING MILL EXHAUST FANS with extra heavy blast wheels designed to operate with the minimum of power Separators to remove dust BEFORE IT ENTERS PAN.

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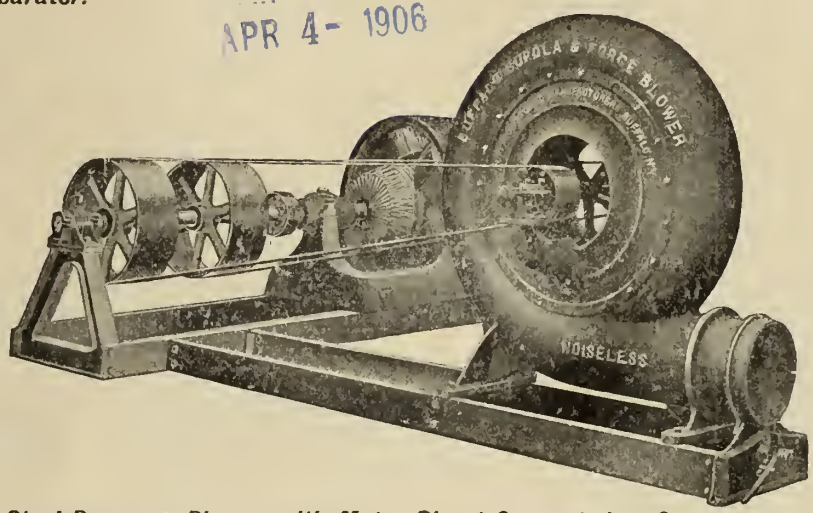
"The running record of a Blower embraces its effectiveness. Its consumption of power, its maintenance, cost and period of usefulness, and should be the determining factor in its choice".—(Extract from Blower Catalogue.)



Steel Pressure Blower with Motor Direct Connected to Countershaft. Note the rachet for Sliding Blower on its Base, which permits the use of an endless belt.

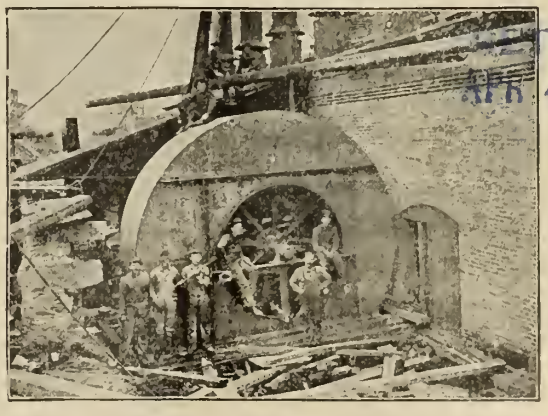
NOTE THE CONSTRUCTION—

To draw the blast wheel it is only necessarry to take off a side plate, which does not disturb the alignment of shaft, nor is it necessary to take the blower from its foundations.

STEEL PLATE FANS

To design the equipment for Heating, Ventilation, or Drying we maintain a staff of skilled engineers. Buffalo installations are invariably successful and satisfactory in operation.

We repay the difference in first cost by saving power and repairs.



Canadian Buffalo Fan in course of erection.

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CANADIAN BUFFALO FORGE CO. LIMITED

MONTREAL, CANADA

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Everybody is looking for a better Dry Battery, then why use Stale and Inferior Batteries—at the same price you can buy the

"BEST" DRY BATTERY

which are always fresh and high standard, having a guaranteed amperage of 22 amperes and 1 and 6.10 volts.

THEY ARE MADE IN CANADA

A trial will certainly prove our claims to be correct, that the "BEST" Dry Battery will prove the most economical Battery in service by test, for Auto's, Gas Engines, Launches, Telephones, etc.

No. 6, 2½ x 6 in.; No. 7, 3 x 7 in.

WE MANUFACTURE POCKET FLASH LIGHTS

Prices to the Trade on Request

Berlin Electrical Mfg. Co.

BERLIN, ONT.

To Our Agents

In appreciation of the excellent work done by our agents—the men who solicit subscriptions for Canadian Machinery—we have decided to make, in addition to cash commissions, a special reward for work done in the next three weeks.

To the agent who sends us the largest number of paid subscriptions between March 1 and March 24, we will give a copy of

The Modern Machinist

Read the advertisement on page 80.

A 250 page book for Machinists, etc.

To the agent who sends the second largest number we will give a copy of

The Life of James Watt

By Andrew Carnegie

Don't lose an hour. Start to work to-day.

Canadian Machinery

TORONTO MONTREAL

From "Torontonians as we see 'em"

W. G. HARRIS, Gen. Manager

HERE ARE TWO

BABBITT METALS

"IMPERIAL" 40c per lb.
No. 4 - 7c per lb.

"IMPERIAL"—No engine too large or particular but this metal will serve.

No. 4—Our lowest metal, for much light work is excellent value.

If you want to know what we know, let us know what you want to know.

We are Babbitt Specialists

THE CANADA METAL CO.

TORONTO

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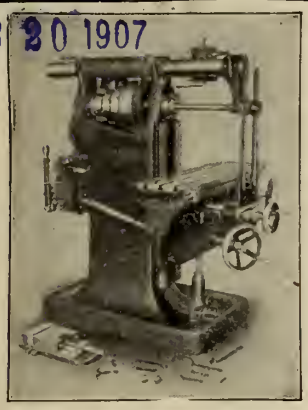
Becker-Brainard Milling Machine Co.

OF

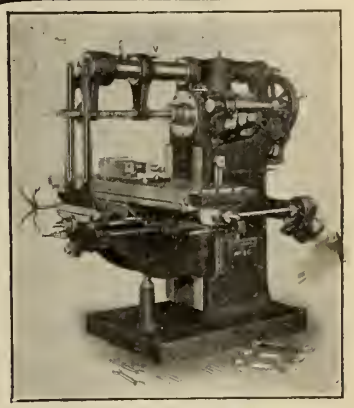
HYDE PARK, MASS.
U. S. A.



When you see that name you know that it represents all that is desirable and necessary for the make up of a practical, durable, money-saving and money-making milling machine.

It is the real merit of our products that has built up the largest milling machine business in the world.
have an attractive catalog which will give you the details in regard to dimensions, etc.

WRITE FOR IT. DON'T PUT IT OFF.

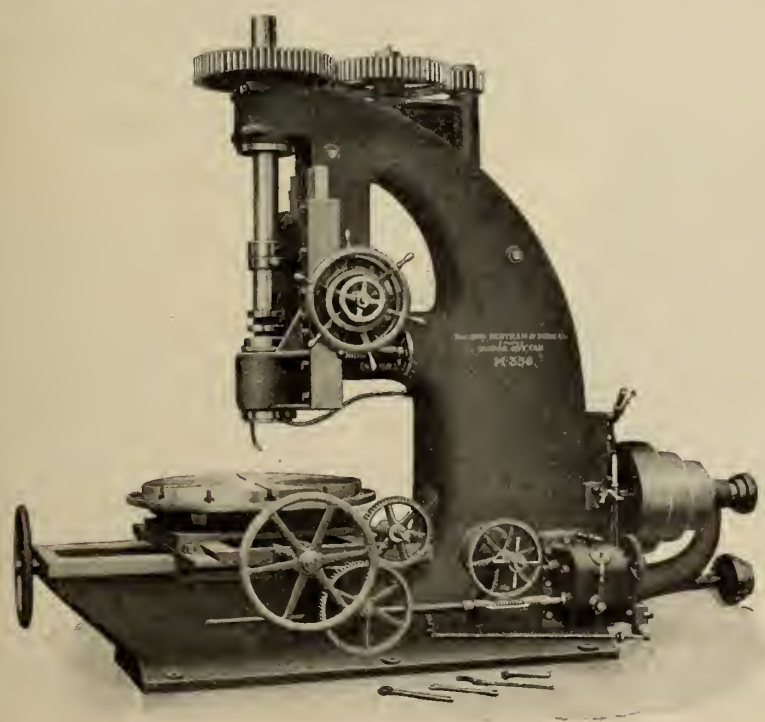


Becker-Brainard Milling Machine Co.

RETURNED Feb 9 1907 to Dunn Cut Book No. 60. Page No. 27

RETURNED FEB 9 1907

The Bertram Vertical Milling Machine



Has a spindle 5 inches diameter

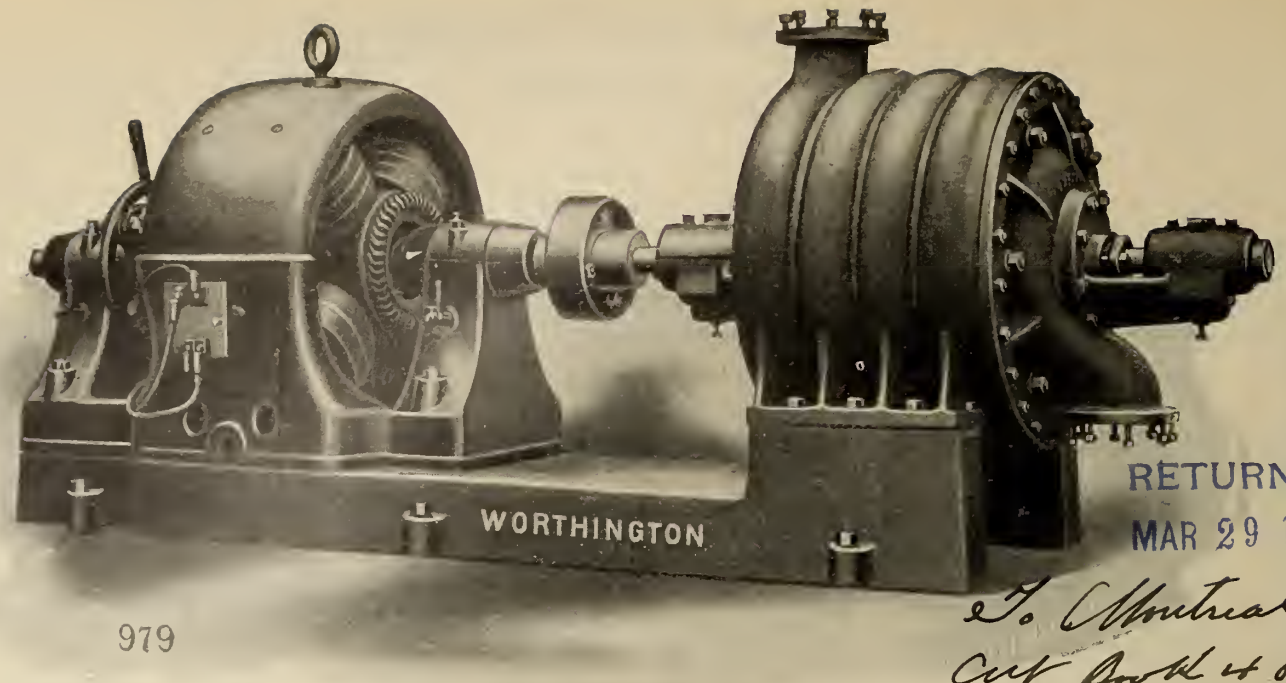
and a combination of strong points which makes it the most powerful machine of its kind built. Attention is called to the powerful train of gear, making it possible to obtain a cutting force of 21,000 lbs. at the circumference of a milling cutter 5 inches in diameter. It has quick-change gear, all of steel. The driving cone has three steps for a 6-inch belt and has 12 changes of speed. All feed motions are conveniently located so that the operator need not leave the working side of the machine. The spindle has a vertical movement. The circular table is provided with power rotary, cross and longitudinal feeds, which are reversible as well as hand adjustment. For fuller information regarding this or any other of the Bertram lines of machine tools, write to

THE

John Bertram & Sons Co.

LIMITED

DUNDAS, Ontario, Canada



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979

Five Inch Four Stage Turbine

Capacity 500 gallons per minute against 520 feet head.
Worthington Turbine Pumps have no guards, no springs, no valves, no rubbing surfaces, no reciprocating parts.
For all heads. For all services.

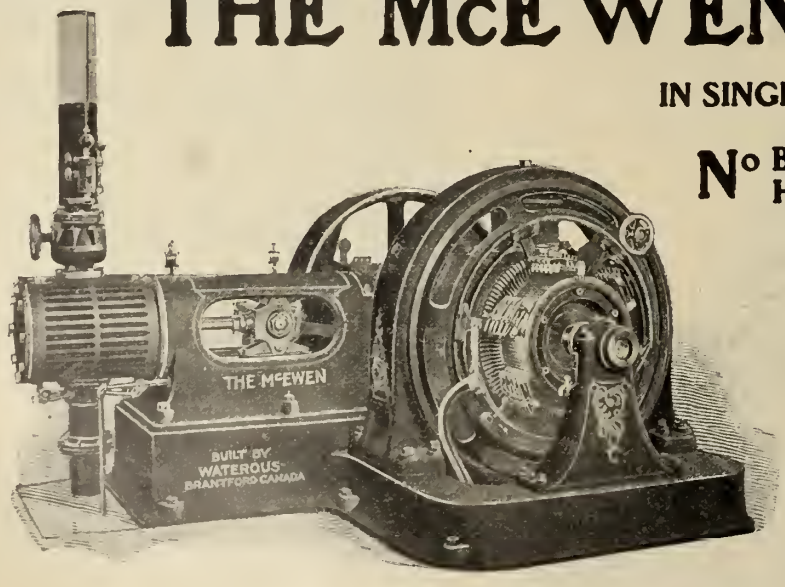
Send for catalogue

The John McDougall Caledonian Iron Works Co., Limited

Builders for Canada, **Montreal, P.Q.**

THE McEWEN High Speed Automatic

IN SINGLE AND COMPOUND UNITS



SIZES 15 TO 400 H.P.

No Better High-Speed Engine Built

GUARANTEE

'The engine shall not run one revolution slower when fully loaded than when running empty, and a reduction of boiler pressure from the greatest to that necessary to do the work will not reduce the speed of the engine one revolution."

This Guarantee cannot be bettered. Always see that it is equalled.

Waterous Engine Works Co., Limited

BRANTFORD, CANADA.

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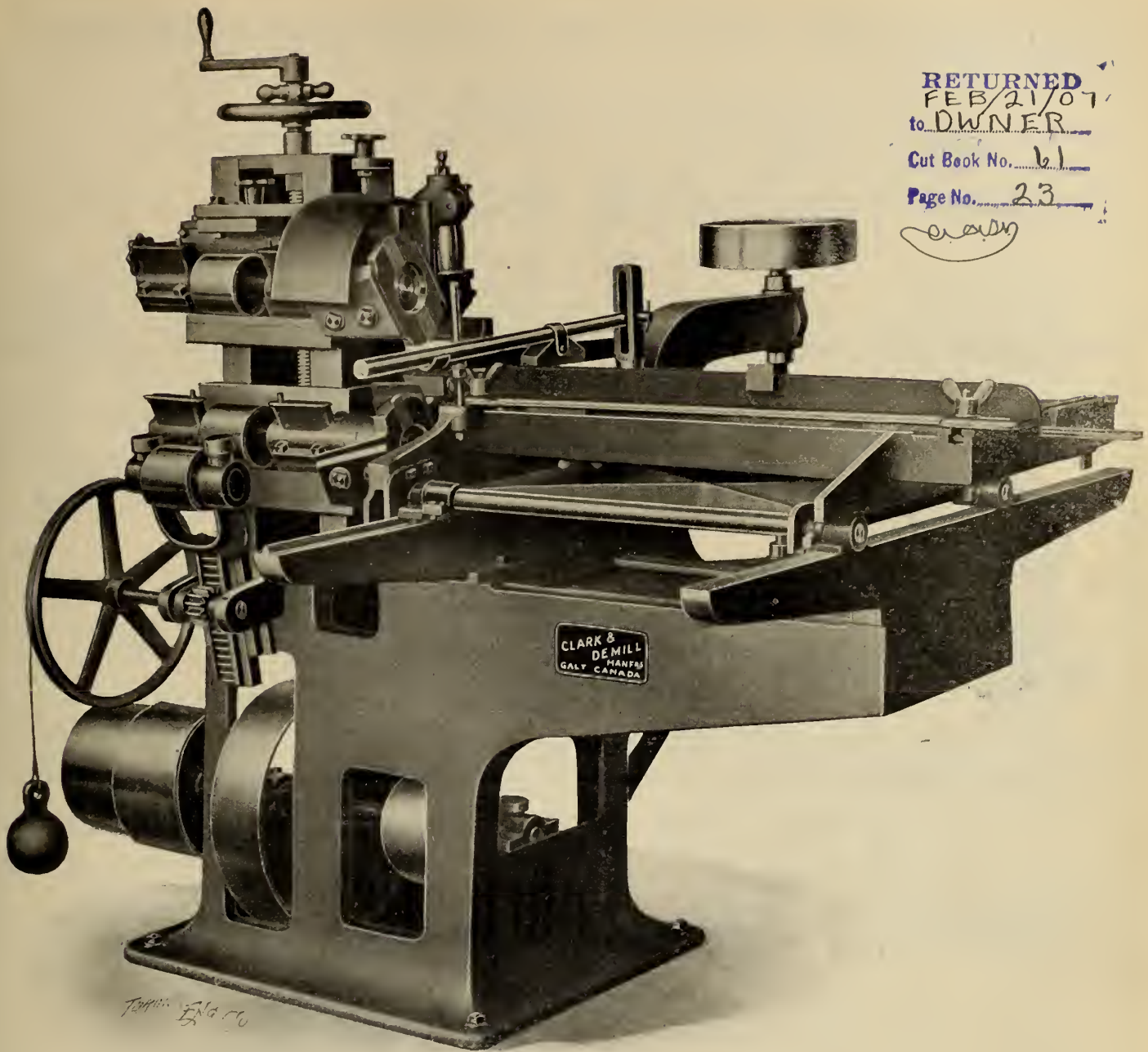
Page No. 23



This is a cut of our No. 75 Tenoning Machine. We regret we cannot explain to you its many points of advantage over other makes of machines in the same class.

The table is of the roller type, moving across the ways with the least possible resistance.

Provision has been made in this machine (as well as all other machines we build) for adjustments of all parts, so that a perfect alignment is assured at all times.

We build a line of machines for Planing Mills, Sash and Door Factories, Furniture, Piano and Organ Factories, etc.

We sell our goods on their merits and we do not build anything cheap, quality being our first consideration.

We presume you are the buyer of machinery such as we supply. We should be pleased to have you correspond with us egarding your requirements. Our entire staff are at your disposal. We solicit an opportunity of explaining to you our goods. t will cost you nothing and you are under no obligation to buy. Ask our representative to call. A line from you will be sufficient.

WE USE CUT GEARS ON ALL OUR MACHINES

CLARK-DEMILL COMPANY, LIMITED, Hespeler, Ontario, Canada

Successors to CLARK & DEMILL, Galt, Ontario, Canada

Selling Agents for Manitoba, Alberta and Saskatchewan:—WATEROUS ENGINE WORKS CO., Winnipeg, Man.

"I WOULD SAY TO STEAM-USERS:

'If you want to save coal, if you want to save repair bills, if you want to prevent shut-downs, if you want to lengthen the life of your boilers, if you want to increase their efficiency—then **SCALE FORMATION** must be prevented.'"

TRI-SODIUM PHOSPHATE

KEEPS BOILERS CLEAN AND FREE FROM SCALE

For complete information about **T. S. P.** write to

The Canada Chemical Manufacturing Company, Limited

London **Canada**

Sylvester Gasoline Engines

Are the best that skilled labor can produce.

They are easy starting; they are simple and reliable; they will give full power in the coldest weather. Made in sizes from 4 to 32 horse power in portable snd stationary and from 1½ to 12 horse power in marine. They will run on gasoline, coal oil or distillates.

The SYLVESTER Engine inspires confidence because it is so simple in construction. It is the cheapest engine to buy because there is nothing to get out of order.

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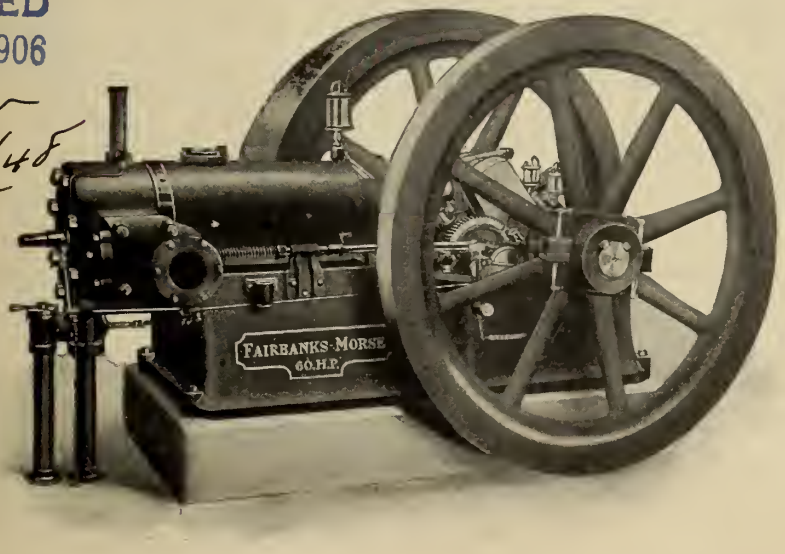

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To Answer Book 48 Page 8

Modern Canadian Manufacturing Plants.

ARTICLE XIII.—The John McDougall Caledonian Iron Works Co., Limited, Montreal.

ONE of the oldest established and best known of Canadian manufacturers is the John McDougall Caledonian Iron Works Co., Montreal, which firm has been in existence since 1853, when it was first launched by the late John McDougall. Since 1892, new and larger steel, frame and brick buildings have been erected throughout the entire plant.

Fig. 1—The John McDougall Caledonian Iron Works, Montreal—Exterior of Boiler Shop.

additional ground having been acquired for that purpose, and machinery of greater capacity has been installed, until to-day the equipment will compare favorably with any in the same line of engineering business.

Boiler Making.

The boiler making department is shown in illustrations 1 and 2, where exterior and interior views of the boiler shop are given. This building has a floor space of 160 x 60 feet, and is completely equipped for the manufacture of boilers of all types, marine, plain tubular, Lancashire, locomotive or water tube, also flumes, penstocks, tanks, stacks, and plate work of all descriptions. This shop is equipped with a traveling crane of 25 tons capacity, which travels the entire length of the shop. At the farther end is the hydraulic riveting plant, which is served by an independent traveling crane, with power hoisting and lowering attachments. This crane is placed in the tower so that boiler shells thirty feet in length may be lifted vertically while being rivetted. Compressed air tools and appliances form an important part of the equipment of this department for lifts, rivetting, drilling, caulking and chipping, the air being supplied by a compound, steam operated, two-stage Ingersoll-Seargant compressor.

In the rear of the boiler shop are two extensions. One of these is the forge shop, with a floor space of 60 x 50 feet, arranged for seven forges, with steam hammer and the necessary cranes. The other extension, with a floor space of 110 x 44 feet, contains the boiler and engine supplying power to the machinery in this department and the air compressor. The remainder of this extension is used as a flange shop, where boiler heads and plates are flanged and formed. This shop also contains the hydraulic press and furnace, with punches and forming dies, for the manu-

facture of the Alexander car replacer, and for forming pressed steel boiler manhole rings, covers, guards, side brackets, flanges, etc.

Metal Casting.

Engraving No. 4 gives an interior view of the foundry, which has a floor space of 140 x 90 feet, with a gallery 22 feet wide on one side, used for the storage of foundry supplies; and charging floor for cupolas. It is equipped with three cupolas, 48, 34 and 24 inches inside diameter, and two No. 7 Sturtevant blowers.

Fig. 2 The John McDougall Caledonian Iron Works, Montreal—Interior of Boiler Shop.

The main floor is served by three jib cranes of fifteen tons capacity each. This foundry is well lighted and airy, and has excellent facilities for turning out large quantities of loam, dry sand or green sand castings, and has turned out pieces weighing up to 25 tons. In rear of the foundry is an inclined driveway, allowing the raw material, pig iron, scrap and coke to be teamed on to the gallery floor. Owing to the foundry's location alongside the Lachine Canal, the floor is only a few feet above the water level and water-tight pits had to be provided to take care of cylinder and other deep work, and to handle pipes, rolls and pieces requiring to be cast on end.

The Machine Shop.

The interior of the machine shop is shown herewith, which has a floor space of 140 x 90 feet, with a gallery 22 feet wide on one side and 28 feet wide on the other. This shop also has a traveling crane of 25 tons capacity, serving its entire length. In the foreground of the cut are the large tools—the chucking lathe, with a capacity for turning a pulley or wheel 20 feet in diameter, and the large planer, which will plane a piece 7 feet high, 7 feet wide and 20 feet long. About the centre of the shop, on the main floor, is the boring mill, which was nominally designed to bore, turn and cut keyseats of pulleys up to 16 feet in diameter, but its range is very elastic, and by means of extensions and additions is used for many other operations than originally intended. To the left of the boring mill is a 67-inch "Gleason" gear cutter, or planer. This machine cuts gear teeth in wood, iron or steel, spur or bevel; its nominal capacity is 67 inches diameter, but it has been used to cut the wooden cogs of core wheels 7 feet in diameter and 14 inches face. In rear of the "Gleason" machine are two rotary cutter machines, used on smaller work. The smaller machines, lathes, drills, etc., are grouped below and in the galleries.

This shop has special facilities for mill work of all kinds, shafting, gearing, pulleys, rope wheels, etc., pulp mill apparatus, starch and glucose work, machinery for rolling mills, sugar refineries, etc. In rear of the machine shop is an extension 60 x 56 feet, two storeys high. On the lower floor is located the power plant, two 75 horse-power water wheels, operating the machine shop, pattern shop and foundry. The upper floor is used as a pattern shop and woodworking department, and is equipped with the necessary lathes, saws and planers. Adjoining this extension is a one-storey brick building, containing the boiler, blowers, etc., for heating these buildings by hot air.

The office is located at the corner of

William and Seigneurs streets. This is a two-storey brick building, 35 x 35 feet, the lower floor of which contains the general and superintendent's office, and the upper floor the general manager's office, sales, engineering and estimating departments. To the left of the office is a three-storey brick building, 80 x 70 feet, used for pattern storage.

Lines Manufactured.

While these works are operated on general engineering and contracting lines, for manufacture and sale of the Worthington turbine pump, steam, belt or electrically driven, and about 80 of these pumps are now in successful operation in sizes from 1 1-2 inches to 16 inches, and under the most varied conditions throughout the Dominion.

Among the other specialties that are manufactured by this company may be mentioned: pressure and gravity filters in connection with the New York Continental Jewell Filtration Co., of New York; wood pulp grinders, centrifugal for manufacture and sale of the Worthington turbine pump, steam, belt or electrically driven, and about 80 of these pumps are now in successful operation in sizes from 1 1-2 inches to 16 inches, and under the most varied conditions throughout the Dominion.

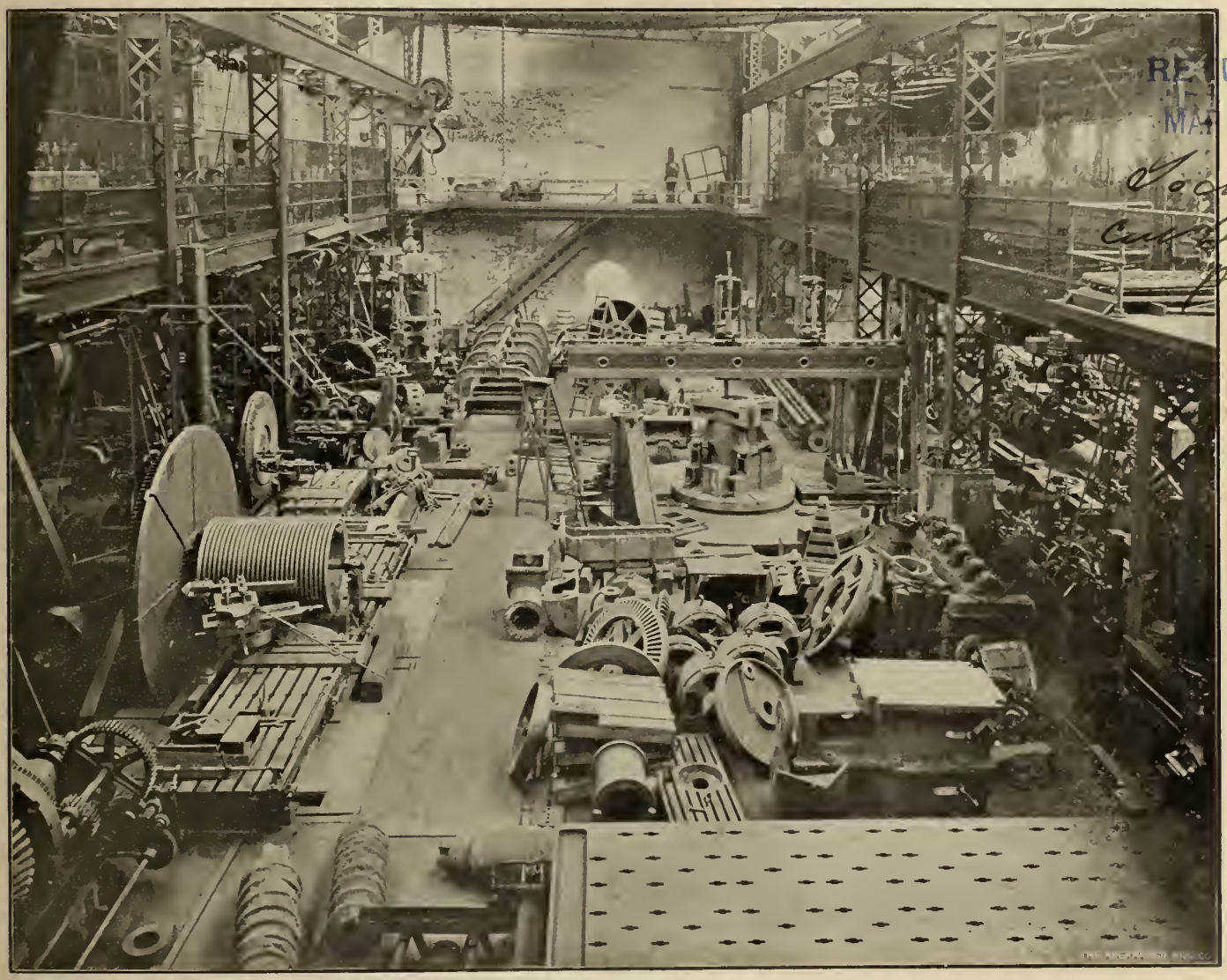
Among the other specialties that are manufactured by this company may be mentioned: pressure and gravity filters in connection with the New York Continental Jewell Filtration Co., of New York; wood pulp grinders, centrifugal and diaphragm screens in connection with the Baker & Shevlin Co., of Saratoga, N.Y.; Doble impact water wheels in connection with the Abner Doble Co., of San Francisco, Cal.: the Tonkin water tube boiler in connection with the Oil Well Supply Co., of Oswego, N.Y.; belt conveying machinery in connection with the Robins Conveying Belt Co., of New York; pressed steel car replacers in connection with the Alexander Car Replacer Co., of Scranton, Pa.

COAL MINING IN SOUTHWESTERN ALBERTA.

By Oliver Hall, M.Sc.

THOUGH an extensive coal field has long been known to exist in Southwestern Alberta, it is only within the last three years that it has been largely exploited. Already, however, three companies in this field are on a large and firm shipping basis, and bid fair to soon rival their older rival, the Crow's Nest Co., on the western side of the Crow's Nest Pass. They are supplying a considerable percentage of the British Columbia smelter coke, and at least one-half of the steam coal of the prairies. These three are the Canadian-American, the West Canadian, and the International Coal & Cooke Companies.

The Canadian-American was the first



RETURNED
MAR 29 1906
Montreal
Card Book 48
page 19
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Fig. 3—The John McDougall Caledonian Iron Works, Montreal—Interior of Machine Shop.

to open up, operating the Frank mine at Frank, of landslide fame.

The successful attempt of Turtle Mountain to go tobogganing here in April, 1903, caused for a time a cessation of all mining, burying one-half the town of Frank, destroying several miles of built and projected railroad, and leaving a block of nearly two and a half square miles of rock debris. The management, with great energy, however, soon recommenced operations, and with

day, but is only developing. It has two seams over 15 feet in thickness, both admirable steam and domestic coal. Its Lille colliery, six miles north of Frank, is on a steady shipping basis of six to nine hundred tons of coal and coke. It operates its own railway, has an up-to-date sizing and picking tipple, and a complete coking plant. It has just completed the first coal washer in Western Canada. This, with its three batteries of Belgian mechanically operated re-

It would seem that the Southwestern Alberta coal field in the vicinity of Frank must, within a few years, be the centre of a tremendous industry. (A large zinc smelter has been built in Frank. Since two tons of coke are needed to smelt one of ore, it is a natural centre. The meteoric settlement of the prairie is causing a tremendous demand for both domestic and steam coal. While the domestic demand can be largely met by the unlimited lignite fields at Souris,

RETURNED
MAR 29 1906
To Montreal
Our Book 48
page 19

Fig. 4 The John McDougall Caledonian Iron Works, Montreal—Interior of Foundry.

the exception of a period of partial closure on account of gob fires, have continued steady shipments of from four to eight hundred tons per day.

The West Canadian collieries, an amalgamation of capital largely French, are operating only at Bellevue and Lille, but have very extensive holdings, over thirty thousand acres in all, with coal outcrops through every parcel. The Bellevue colliery, two miles east of Frank, is outputting only 250 tons per

tort ovens, gives it perhaps the best coking plant in the west.

The International Coal & Coke Co. have opened up large collieries at Coleman, six miles west of Frank. They have a first-class plant in every way, outputting about 1,000 tons daily and capable of at least 2,000. They have both compressed air and electric haulage, a very extensive tipple, and over two hundred bee-hive coke ovens.

Lethbridge, Edmonton and elsewhere, for steam purposes, it is to the Southwestern Alberta field that the west must look. Coal alone is already creating a freight traffic on the Crow greater than that on the main line, and with the completion of the new railways, it must treble. The Canadian Northern has already placed orders, and the Grand Trunk Pacific, when constructed, will greatly increase the demand.

Steam Turbine Pump at Waterloo, Ont.

AN interesting pumping installation is that recently installed at the municipal pumping plant at Waterloo, Ont., of which some illustrations are presented.

The pumping unit is of the centrifugal type and is driven by a De Laval steam turbine. The entire outfit was manufactured by Messrs. Greenwood & Batley, of Leeds, England, and installed by the D'Olier Engineering Co., of New York and Philadelphia. The pump is designed for a service of 2,000,000 imperial gallons, each twenty-four hours against a total head of 218 feet. It will be seen from the cut that the pump part of the unit really consists of two separate pumps, these being connected by pipe bends so as to add their effects. The entire outfit is mounted on a single subbase and is consequently self-contained. The construction details of the De Laval steam turbine are quite generally known. However, the De Laval pump is possibly not so familiar.

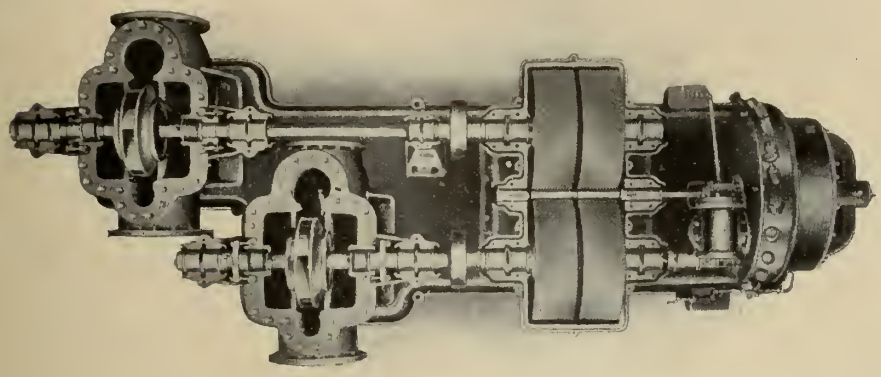


Fig 1—Pump Case and Gear Case Covers Removed.

The cut shows the De Laval pump with the upper part of the pump and gear cases removed, showing clearly the running parts. It will be noted that the pumps are equipped with ring oiling bearings and that the packing boxes are made separate from the bearings, a feature which has proven extremely desirable in practice, as has also the split pump case arrangement, which thus allows access to the interior of the pump without disturbing the piping connections.

The chart given herewith shows the performance of the pump, and it will be noted from this that the duty secured is in the neighborhood of 75,000,000 foot pounds per 1,000 pounds of dry steam, and that the efficiency of the pump end of the unit is only slightly less than 70 per cent.

The entire pumping set is a very compact one and occupies over all a space of 14 feet 3 inches long by 6 feet 4 inches wide, and a height less than 5 feet.

The pump is provided with centrifugal governor for regulating the speed and it will be seen from the characteristic curve of the delivery and pressure produced by the pump, that even with all valves shut on the discharge, the pressure will not run up dangerously, the shut-off pressure for this pump being equivalent to a height of 288 feet.

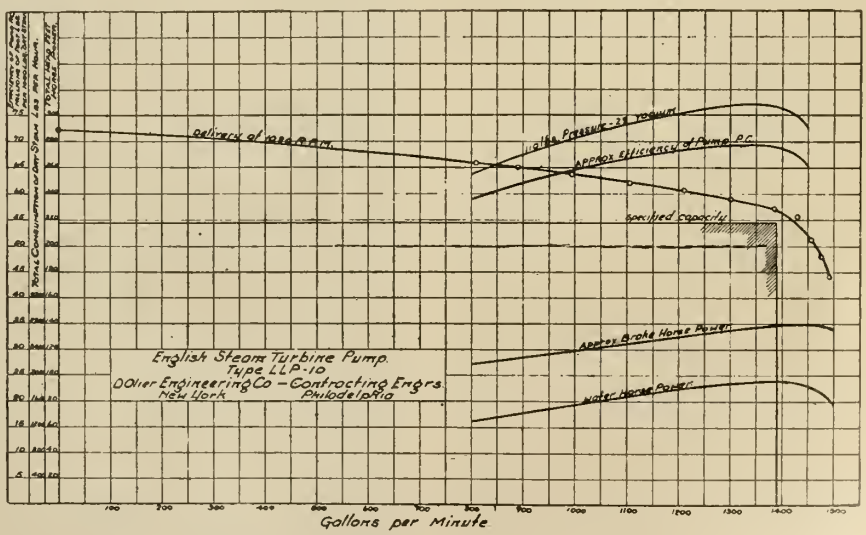


Fig. 3—Operation of Steam Turbine Pump, Waterloo, Ontario.

INTERESTING STEAM ENGINE TEST.

AN interesting official fifteen hour test of one of the nine twin vertical-horizontal Reynolds Corliss engines, cylinders 42 inches and 86 inches by 60 inches, which have been in operation at the 59th Street Station of the Interborough Rapid Transit Co., New York City, since 1902, was concluded December 15. The tests were conducted by the Interborough Rapid Transit Co. and representatives of the Allis-Chalmers Co. as a final determination of the fulfillment of the builder's guarantee, and formally provided for in the original contracts.

How well the tests of engine No. 8, which was selected as representing all the engines installed, fulfilled the claims made for it, may be readily ascertained from the following data giving a synopsis of the completed tests.

As per agreement, on account of the impossibility of keeping a constant load, the power was determined by the readings of tested integrating wattmeters. These readings were reduced to I.H.P. by running the generator as a synchronous motor; adding the electrical input to the switchboard readings when developing power, to obtain the power exerted by the engine.

The result of the test so made, under conditions approximating the contract requirements of 7,500 H.P., 75 r.p.m., 175 pounds steam pressure and 26 inches vacuum, was a consumption of 11.96 pounds of dry saturated steam per I.H.P. hour, or well within our guarantee of 12.25 pounds. The steam consumption per k.w. hour at the switchboard was 17.34 pounds.

Duration	15 hours.
Load	5079.2 K.W.
Friction and Generator losses	417.3 K.W.= 559.41 H.P.

Total Load	5496.5 K.W.
I.H.P.	7365.3 H. P.
R.P.H	75.02
Steam Pressure	175.18 lbs.
R.H. Receiver	19. 1 lbs.
L. H. Receiver	19.27 lbs.

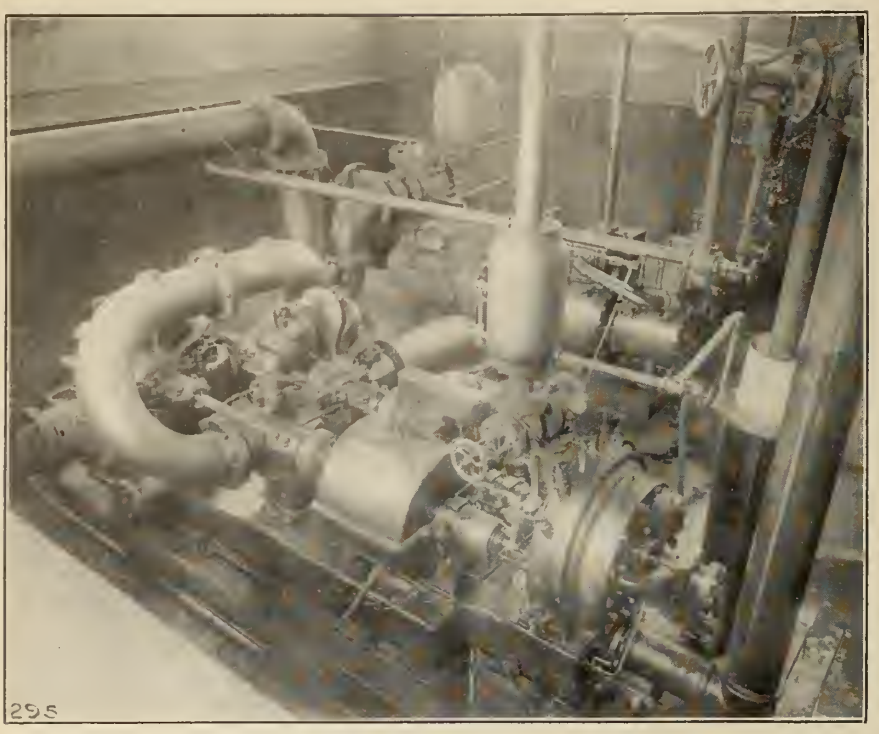


Fig. 3—De Laval Pump Installed at Waterloo, Ontario.

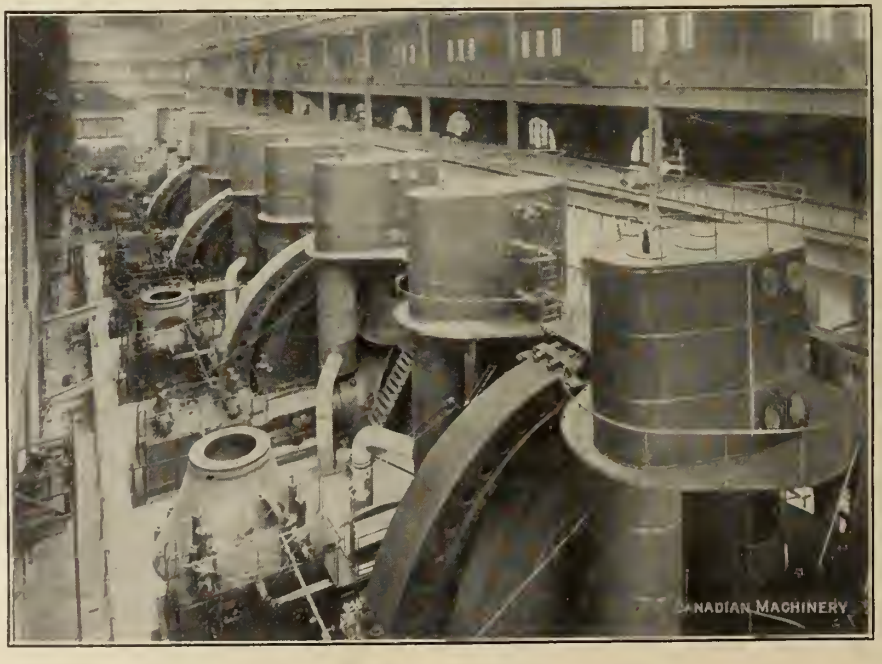
Vacuum	26.02 lbs. (actual.)
Temp. Injection Water	42 36 deg.
" R.H. Discharge	74.05 deg.
" L.H. "	77.38 deg.
Barometer	30.50 lbs.
Water per hour	89.906 lbs.
Drips per hour	512 lbs.
Leakage per hour (boiler)	1.470 lbs.
Boiler Level Correction	60 lbs.
Net Water per hour	87.864 lbs.
Quality of Steam	100.28
Dry Steam per hour	88.110 lbs.
Dry Steam per K.W.H	17.34 lbs.
Dry Steam per I.H.P.	11.96 lbs.

The final results allow for boiler leakage, which was determined by a separate test of 24 hours duration. The steam was very slightly superheated during the test, as being easier to make allowance for than wet steam, and a correction was made to reduce the superheated steam to equivalent dry saturated steam.

The vacuum was carried at 26.02 inches, or as near the contract requirement as possible, but the barometer stood at 30.50 inches. The vacuum was, therefore, equivalent to only 25.52 inches referred to 30 in. barometer; no correction was made, however, as none was provided for in the contract. Other tests at varying vacua show that if the vacuum had been carried enough higher to correspond to 26 in. vacuum when referred to 30 in. barometer, the steam consumption would have been about 0.09 lbs. better, or 11.87 lbs. per I.H.P. hour instead of the official figure of 11.96 lbs.

The tests were under the supervision of Frank N. Waterman, who acted as referee. The following represented their several companies: Interborough Rapid Transit Co., H. G. Scott, superintendent motive power; J. Van Vleck, mechanical engineer; H. W. Butler, principal assistant engineer; Thomas Allsop, mechanical engineer, 59th Street Power Station; C. W. Ricker, electrical superintendent; G. F. Chellis, instrument man; W. L. Seabrooke and W. S. Finlay, assistant engineers.

Allis-Chalmers Co.—A. H. Mattice, chief engineer; Samuel Moore, district superintendent of erection; T. T. Hubbard, engineer test; J. W. Lord, sales representative; C. A. Hoppen and C. J. Larsen, construction department; A. F. Rolf and F. Buch, electrical representatives.



Allis-Chalmers Engines on which test was made.

Doing Things.

Proprietor of Big Iron Works—If I understand you correctly, you wish to place an order for armor plate that no cannon shot can pierce. We are turning out that kind of thing every day—

Agent of Foreign Government—No; you misunderstand. I wish to know if you can manufacture a cannon that can pierce any armor plate?

Proprietor—Certainly, sir. We are doing that kind of thing every day, too. —Answers.

Gratifying Ambition.

Men have two kinds of ambition—one for dollar-making, the other for life-making. Some turn all their ability, education, health, and energy toward the first of these—dollar-making—and call the result success. Others turn them toward the second—into character, usefulness, helpfulness — life-making — and the world sometimes calls them failures; but history calls them successes. No price is too great to pay for an untarnished name.—Success Magazine.

PERSONAL MENTION

Thomas J. Drummond.

MR. THOMAS J. DRUMMOND, who was recently elected by acclamation to the position of second vice-president of the Montreal Board of Trade, is one of the most remarkable business men in the country. Though by no means one who would court publicity his intimate connection with the upbuilding of the Canadian iron and steel industry during the past few years has persistently brought him the public notice. Especially as vice-president of the Lake Superior Corporation he has won great admiration for the plucky fight by which he and his associates have lifted a defunct concern to the level of a good business proposition, and have breathed life into a city where trade was almost at a standstill.

Mr. Drummond's business interests are many and all of them are closely linked with the country's growth and prosperity. He is a partner in the firm of Drummond, McCall & Co., is president of the Montreal Pipe Foundry Co., president of the Londonderry Iron & Mining Co., vice-president of the Canadian Iron & Foundry Co., vice-president of the Lake Superior Corporation, director of the Montreal Water & Power Co., director of the Imperial Life Assurance Co., and secretary of the Canada Iron Furnace Co. He is a member of the executive of the Montreal branch Canadian Manufacturers' Association, and has many other business interests of a less public nature

Thomas J. Drummond,
Elected Second Vice-President Montreal Board of Trade

New General Manager.

IT is officially announced Mr. James A. Milne has accepted the position of general manager of Allis-Chalmers-Bullock, Limited, Montreal. Mr. Milne is a native of Canada, having been born at Waterdown, Ont., in 1872, and is one of the many Canadians who have made their mark in the United States.

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After completing a public school and collegiate course he began his business career at Toronto in 1888. During the ensuing four years he was with Robert Simpson & Co. and Wyld, Grasett & Darling, of that place, but in 1892 he removed to Chicago, entering the employ of Carson, Pirie, Scott & Company. Subsequently he worked for Reid, Murdock & Co. and the Chicago Packing & Provision Co.—for the latter as chief accountant. Then he became associated with Jones, Caesar & Company, chartered accountants, of Chicago and New York, and it was this connection which brought him into touch with the Allis-Chalmers Company. In August, 1901, he entered their employ as chief cost clerk, and one month later was appointed acting comptroller, being formally elected to that position at the meeting of the board of directors in May 1902. Since the early part of last Autumn Mr. Milne has been one of the directors of Allis-Chalmers-Bullock, Limited, and the fact that he still retains Canadian citizenship, and is deeply attached to his early associations, has been an important factor in influencing him to heed a recall to the Dominion.

J. A. Milne,
General Manager Allis-Chalmers-Bullock.

A New Profession.

ONE of Canada's greatest needs for its industrial progress is the work of technical men who combine their technical knowledge with the sound common sense and an appreciation of the conditions of the matter on hand. One who understands Canada's conditions and needs as well as possessing the technical knowledge and experience, is therefore especially fitted for our needs now.

J. A. DeCew,
Chemical Engineer.

For this reason it is gratifying to announce the establishment in our midst of a member of the chemical engineering profession in the person of Mr. J. A. DeCew.

If Mr. DeCew is somewhat of a pioneer in his chosen work, it is natural, as he comes from the pioneer stock of Western Ontario. He is a graduate of Toronto University, in analytical and applied chemistry, and later spent a year there in research work on cellulose products. Besides his thorough technical training, Mr. DeCew has had wide experience in engineering, in connection with lumbering interests in Oregon, Washington and British Columbia, and later, in industrial chemistry as chief chemist of the Canada Paper Co.'s mills at Windsor Mills.

Mr. DeCew has attained the foremost rank in his profession, being a member of the Society of Chemical Industry, the International Society of Paper Mill Chemists, the American Society for Testing Materials, and the International Society for Testing Materials.

Mr. J. J. Sophus, of McLean & Sophus, Montreal, spent a couple of weeks in February extending the firm's business in Toronto and Hamilton, where he met with a liberal response from the trade in placing different lines for which McLean & Sophus are exclusive Canadian agents.

CANADIAN MACHINERY
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Vol. II. MARCH, 1906 No. 3

NEW ADVERTISERS IN THIS ISSUE:

Cleveland Automatic Machine Co., Cleveland.
Electric Blue Print Co, Montreal.
John McDougall Caledonian Iron Works Co., Montreal.
Siegwart Beam Co., Lucerne, Switzerland.

ADVERTISING TOWNS AND CITIES.

RECENTLY some Canadian cities were given a proposition regarding advertising their virtues as manufacturing centres in a set of United States magazines and indications point towards a decided step in this direction. Reference has already been made in these columns to the value of publicity on the part of Canadian towns and cities. As matters stand at present the larger cities are enticing the cream of the manufacturing establishments that are being started in this country. According to the report of the Illinois Manufacturing Association 132 of the leading concerns of the United States have been forced to establish manufacturing branches in Canada. The value of these is estimated at $50,000,000. These are figures that should make public spirited citizens of every town and village pause a moment for reflection. Had the advantages of different centres been known by the firms mentioned many of the locations might have been changed. This is a vital moment to the smaller towns where their only hope of growth is in attracting live manufacturing concerns. The metal working industries alone are not sufficient. Industries must be attracted where female employment is given as well as to skilled mechanics. If the towns showed some of the enterprise as corporations that individual members of its business communities show they would not hesitate a moment in circulating far and near the advantages they can offer to induce manufacturers small and large to commence operations within their community. This should not be merely a passing thought but an inborn conviction with the council of every town. Publicity in the papers that circulate from one end of the country to the other is what is needed, and it is hoped that the smaller towns will become alive to the possibilities in this direction, and have the satisfaction of expanding to the greatest possible extent.

Advertise your home town. Some towns are doing this at present with beneficial results. Other places stand by in silence and wonder why they do not receive inquiries from prospective manufacturers as they see one important industry after another locating elsewhere. Get busy. Let the outside world know what you have to offer and note the result. This is the growing time and there is no time like the present.

FACTORS TOWARD SUCCESS.

IT is hard to classify and to give due credit to the various factors which contribute to success in any business. One man emphasizes the necessity of aggressiveness in the sales department—enterprise in making sales and firmness in holding out for a definite price. Another man lays particular stress on the necessity of constant care over manufacturing cost—to the end of producing better goods than one's competitor at equal if not lower cost.

Both men may win success, yet if the general experience of successful men were taken it would demonstrate beyond question that both aggressiveness in selling and economy of production are essential factors to the building up of a large business.

In view of this the manufacturer, whose inclination is toward the mechanical end of his business, should never lose sight of the necessity of enterprise in the sale of his products.

To this end he should use every effective factor which will make his selling force more profitable.

One factor which should never be lost sight of is the necessity of keeping one's name before the buyers he desires to reach. How can this be done most economically?

To answer this entails a study of one's business and of the various mediums through which one could keep his name before the buyers he wants to reach.

For the manufacturer or merchant who has to sell such lines as soaps, pianos, etc., to the average householder, the daily paper, the illustrated weekly, or the popular monthly, is the natural, the most efficient, medium; on the other hand, the manufacturer of machinery, of power equipment, of manufacturers' supplies,

or any such lines, will find most effective and consequently most economical a medium going directly to the owners or superintendents of manufacturing plants—to those who buy the goods he handles.

MODEL EMPLOYES' CLUBS.

SOME of the large manufacturers in the United States have organized clubs, known by the name of the firm, and operated to contribute to the comfort, social intercourse and efficiency of the employes. Every firm employing thirty men, or over, should have such a club, its scope, of course, depending upon the number of men in the establishment. In a place where a large number of men are employed it might provide a dining room where meals would be furnished at cost, as well as rooms for recreation and fellowship. If the number be small club rooms open every night could be secured at trifling individual expense. Here the men might meet and exchange ideas and arrange for a monthly or fortnightly talk by the heads of some of the departments, to the benefit of all concerned. The men would thus become more intelligent, better acquainted with those in authority over them, and an esprit de corps established that may not now exist. The latent possibilities of this idea are great. Every employer of labor should give it some serious thought.

With any and all interested in the formation of such a club we are glad to co-operate and offer suggestions in the shape of a constitution and by-laws for such an organization.

CENTRAL POWER STATIONS AT MINES.

EDISON has made many prophecies, most of which he has been himself mainly instrumental in fulfilling. One of his more recent glimpses into the future is to the effect that before long enormous central stations for the generation of electricity will be situated at the coal mines, and the power delivered by wire at low cost to manufacturing plants, instead of by railroad.

This idea is already under consideration with every prospect of its being carried out at Amherst, N.S., by the management of the Maritime Coal & Railway Company, whose mine is eight miles from the town. Amherst is the industrial centre of the Maritime Provinces, and cheap electric power should prove a further boon. It is proposed to establish at the coal mines a central power station and generate electricity on a large scale. At a recent meeting of the Board of Trade of Amherst, N. Curry, president of the Rhodes, Curry Co.; D. W. Robb, president of the Robb Engineering Co.; H. L. Hewson, president of the Hewson Woolen Mills, and other prominent gentlemen, expressed favorable opinions to the scheme of thus supplying power. The right to enter the town with a pole line has already been granted, so that there is every assurance of the successful operation of the plan within the next few months.

INSTAL THE LATEST MACHINERY

WHEN a manufacturer attempts to run his plant with antiquated machines and apparatus he places himself on a footing with the farmer plowing by means of oxen and sowing and reaping by hand, as one hopelessly out of the running in competition with the up-to-date rival. A striking example of this has taken place in the woolen trade in Canada during the past few years. The directors of different of these plants were more anxious for present dividends than in adopting the latest ideas. Everybody knows the result. Many of the mills were shut down at a total loss, unable to compete with the British manufacturers in the same line who had been throwing on the scrap heap thousands of dollars' worth of machines every year, to make room for the latest and best.

The moral is obvious.

It cannot be too strongly impressed on the manufacturers to-day to instal the most efficient and up-to-date machinery the market affords, as the additional outlay will return to him many fold through the channels of happier and better workmen, increased output, higher prices, satisfied customers and more of them.

TENDENCY IN ENGINEERING PRACTICE.

ONE is constantly reminded of the fact that modern conditions have created a new era in engineering practice in connection with prime movers. Small units are giving way to large, slow speeds have been increased to high, steam pressures have doubled and trebled, voltages have risen from one or two thousand to sixty thousand and higher, and transmission lines lengthened from a few miles to many. People wonder when the limit will be reached, when will that stage have been gained at which power units will be made no larger, speeds no greater, pressures incapable of increase, and potentials beyond the power of insulation. Meanwhile the cycle continues and the movement is unabated in the direction of units, greater and greater, and potentials, pressures and velocities, higher and higher. Engineers and designers are busy creating monsters, only to find that they command attention for but a few months at best, when they are superseded by others of still greater capacity. It takes some nerve to design a machine with a peripheral speed of four miles a minute, and no small calculation to get proper shapes that stresses may be uniformly distributed and minimized at this speed. But who will say that the limit has been reached?

A prominent electrical engineer predicts that the next few years will see units of 25,000 k.w., while at present we are marveling at leviathans of half that capacity. In spite of this there must come before long a halt, for sooner or later we will arrive at the point, a mean between size or speed or pressure and economy to build, operate and maintain.

Modern Tendency in Boiler Practice

By H. W. Weller, A.M.I.C.E. and M.AM. Inst. E.E.

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Early Development.

FROM 130 B.C., when Hero of Alexandria brought out his "Aetoipile," or rotating steam engine, to the present day is a far cry, but the fact that the latest development in steam power, namely the turbine of to-day, depends upon the application of the same principle as that of Hero's ancient prime mover, proves again that "there is nothing new under the sun." It is not within the scope of the following remarks to refer to the various inventors from the above commencement to the time in 1712 when Thomas Newcomen accidentally discovered the condensation of steam by a jet of cold water, and the various improvements made by John Smeaton and James Watt in 1760-1770, and the marked advances by Boulton and Watt a few years later.

Boiler Installation, Canada Car Co., Montreal.

In all these earlier experiments and achievements the steam pressure was very low, probably never exceeding 20 lbs., the inventors depending largely on the vacuum produced by the cold water injected into the cylinder to condense the steam. Up to 1781 all the steam engines were single acting and only used for pumping purposes, but in that year Watt obtained a patent for a double acting engine, which was the first important step in the production of a "continuous motion" engine.

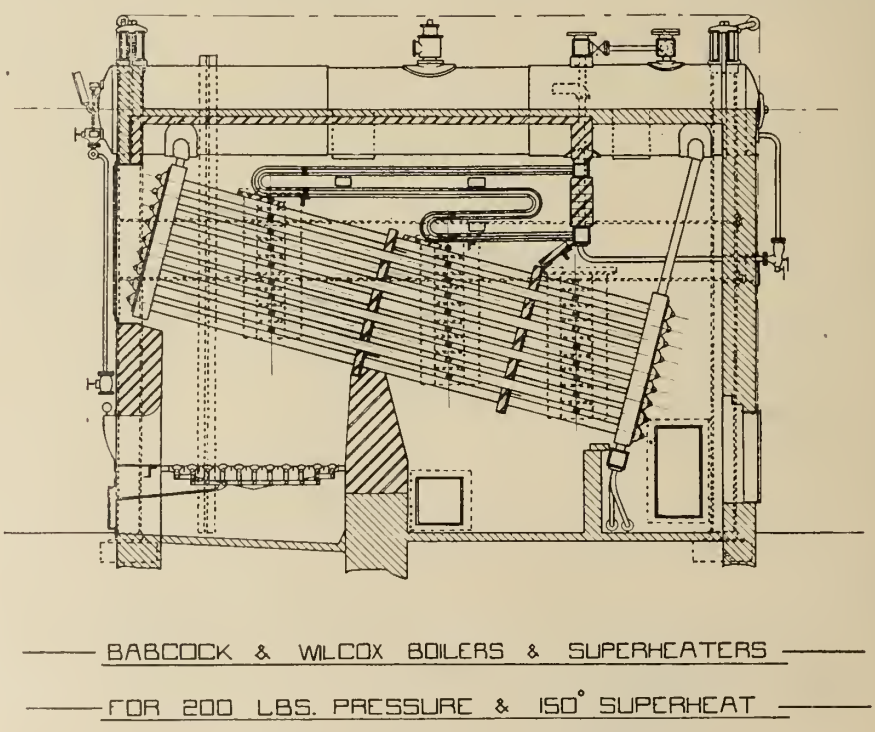
Onward Progress.

It is not intended here to follow the various advances made in the development of the steam engine, which would no doubt be very interesting and instructive to many readers, but rather to point out the steady increase of steam pressures from the days of Watt until the present time. The march of progress is always onward, and the pressure of 20 lbs. in the beginning of the nineteenth century caused more wonderment than 250 lbs. does at the present time. To-day with our modern triple expansion engines and steam turbines, 250 lbs. and 150 degrees of super-heat is not at all uncommon, and if we would develop our steam power to-day at the least possible cost in order to compete with water power and gas engines, we must have engines and boilers of the highest efficiency, and to obtain that efficiency we must look for it in high pressures and super-heated steam. It is true that our engines must be stronger and better made, and that the design, material and workmanship of our boilers must be, like Caesar's wife, "above suspicion." Furthermore, our engineers and firemen must be better educated and more intelligent men and ready to carefully consider the various advances made from time to time and not prone to condemn any new idea because they do not understand it, or say "what was good enough for their father is good enough for them."

In the boiler, the progress made has not been rapid. Men have been inclined to consider that anything called a boiler which an inspector would pass, was good enough for them, and looked upon the various troubles and repairs as necessary evils, and that an occasional explosion was only a part of the business, and that anyone who was unfitted by lack of intelligence for a more responsible position was good enough to shovel coal into the furnace—and that so much coal just had to be burned anyway.

To-day manufacturers are beginning to see with different eyes, and are tending to give more of the intelligent care they use in other departments of their business to the boiler room.

The old egg-ended boilers, internally fired boilers, and later the horizontal tubular or fire tube boilers, have been successively used, and each has filled its place in the onward march, but as the pressures have kept increasing they have reached the limit of their safe commercial usefulness, and to-day practical, up-



Boiler being Installed in Incinerator Plant, Westmount.

to-date engineers realize that if safety and economy are to be realized they must look elsewhere for the steam generator of the future. Some fifty years ago inventors started to build pipe boilers in which the water was contained inside the pipes, and many arrangements were tried, one after another proving failures. But the water tube boiler was the rational outcome of the desire for safe and economical steam generation, and to-day we probably have over 20,000,000 horse-power of one kind and another in use. Of course inventors have been prolific in ideas, and many of the types brought out have been abandoned owing to the lack of the fundamental principles underlying the production of a successful boiler, and this has brought abuse and discredit upon all boilers of this type. It may, therefore, be interesting to some Canadian Machinery readers to have put before them a few of the main points which must not be lost sight of, if we would have a successful and satisfactory boiler. These rules were laid down many years ago by Mr. George Babcock, one of the pioneers in this line of engineering, and his judgment has been upheld by all the best engineers of the last twenty-five years.

Boiler Requirements.

The essentials of a perfect steam boiler may be given briefly as follows :

1. A large factor of safety.
2. Steam and water capacity sufficient to care for sudden fluctuations of load.
3. A proper arrangement of heating surface to thoroughly absorb the heat of the gases.
4. The absence of any stayed surfaces.
5. Straight tubes so that they can be cleaned easily and so that you can see through them and know that they are clean.
6. Sectional construction to insure safety and ease of repair.
7. Wrought steel construction throughout.
8. Ample surface to disengage the steam easily so as to avoid priming or a fluctuating water level.
9. Expansion and contraction properly provided for.
10. And last, but not least, a perfect and positive circulation of the water.

Added to the above it is imperative on the score of economy that the soot can be easily removed from the heating surface, while the boiler is in operation, preferably by means of air or steam jets.

To-day we have several plants in Canada where the engineers have recognized the value of the higher pressures, two of which are illustrated.

The Canada Car Co. have installed water tube boilers good for a continuous working pressure of 200 lbs. and fitted with steam super-heaters capable of imparting 150 degrees F. of super-heat to the steam.

Recent Installations.

The Corporation of Westmount for their new destructor and electric light plant have done the same. Also we may mention the Central Electric Co., the Northern Electric Co. and the Locomotive & Machine Co., while the C.P.R. at their Angus shops have a large boiler built for 300 lbs. working pressure and 150 degrees F. of super-heat.

It may not be out of place to point out that all the most recent and up-to-date battleships and cruisers of the British and American navies have been equipped with the straight tube type of water tube boilers. There is a saving of half the weight and the ability to carry 250 lbs. working pressure indefinitely, and you have the most powerful reasons for the use of the water tube boiler for marine work. The Dominion ice-breaker "Montcalm," which has been doing such good work on the lower St. Lawrence for the past twelve months, is equipped with 4,500 horse-power of water tube boilers of the Babcock & Wilcox make, and H.M.S. Dominion, which brought home the body of the late Minister of Marine, is fitted with 18,000 horse-power of water tube boilers of the same make.

Advantages of Superheat.

In conclusion it might be well to further emphasize the advantages of moderate super-heat of say 100 to 150 degrees F.

In most plants, if properly piped and protected, this amount of super-heat will not only avoid condensation in the steam mains, but will practically eliminate the condensation losses in the high pressure cylinders of the engine and this alone will show an actual saving varying from 10 to 25 per cent. according to the class of engine and its condition. This, coupled to the saving effected by the use of high pressure steam, and boilers that can be cleaned and kept up to their efficiency while at work, is of such importance in considering the cost of operation that no thinking user of steam can afford to disregard it.

In a series of tests made on the steamer J. C. Wallace last Summer on the Great Lakes, by Commander White of the United States navy, the first two were made with super-heated steam only 82 and 88 degrees F. respectively, the dry coal burned per I.H.P. was 1.464 and 1.598 lb. per hour and with saturated steam 1.747 and 1.713 lb. per hour, the engine being a high class triple expansion. With a less economical engine the relative saving would be much greater.

VALUING COALS BY TEST AND ANALYSIS.

By J. A. DeCew, B.A.Sc., Chemical Engineer.

THE statement we sometimes hear that "coal is coal," has about the same significance as if the person had said "wood is wood;" and this, to an inhabitant of America, with its many and beautiful varieties and species, is a sly bit of humor. In the former case, however, the evidence to the contrary is not so apparent, and it is not so generally recognized that a close relationship exists between the economy of the steam boiler and the quality and character of the coal it consumes.

The economical coal for one boiler plant is not necessarily the most economical for another, on account of such difference in conditions as, kind of furnace, area of grate surface, draft available, etc. It follows, therefore, that the only way to determine the coal having the character most suitable for any steam boiler, is to make a practical test under the ordinary running conditions of the plant.

The results of this trial, however, are limited in their value and application, unless we know something of the characteristics and qualities of the material under consideration. These factors are determined from an approximate analysis and determination of the calorific value of coal.

Experience may be thus recorded in a terminology, that is, definite, descriptive and specific, from which is finally evolved a knowledge of the exact specification of the material which will be most suitable for certain conditions and circumstances.

Let us now note more specifically some of the variable factors upon which depends the cost of steam production.

1. We have the relative cost per ton of the different kinds delivered at the boiler.
2. The relative total heating value per pound or per ton.
3. The relative percentage of heating value which may be utilized in the boiler.
4. The maximum capacity or horse-power that can be developed by the boiler with different coals.
5. The relative smokelessness when used in the particular boilers and furnaces under consideration.

Now, with proper experimental work, using coals whose characteristics are known in terms of their proximate analysis, it is possible to eliminate the last four variables by ascertaining the proportion of constituents, such as moisture, ash, volatile and fixed carbon, which produce the best results in actual trial.

Let us now assume that this stage has been reached and that the purchaser knows the characteristics of the material he wants. Then, all we have left to consider is the cost per ton and the total heating value of the material.

Thus follows the simple proposition that, other things being equal, the value of a coal varies directly with the calorific value. For instance, if the consumer gets 13,000 B.T.U. per pound of coal at one time, and 12,000 at another, he is not paying the same price for his coal. It is possible to obtain a fair idea of the value of a coal from the proximate analysis alone, thus:

The amount of volatile matter expressed as a percentage of the combustible, classifies the coal as anthracite, semi-bituminous or bituminous.

The moisture in a bituminous coal is an important guide as to its character.

The quantity of ash is a criterion of value because it interferes with evaporation power by reducing the amount of combustible and also by enclosing particles of carbon, which retards excess of air and prevents complete combustion.

The amount of sulphur in a coal is also an indication of the value of coal, for high sulphur is generally found in a coal that clinkers badly, and from which it is hard to obtain the rated capacity of the boiler.

Therefore, why should we ignore these important factors in the choice and use of a material which is the basis of nearly all industry Even if chemical methods have occasionally produced unsatisfactory results when they lacked the practical knowledge of the man on the spot, yet, why should the man in charge and with the responsibility on his shoulders, limit and retard his efficiency by ignoring the assistance and failing to utilize the methods of science that are now at his disposal, the sole aim of which is to assist in the production of economies and profits?

Recent Engine and Boiler Patents.

SOME of the latest inventions dealing with patents, with their object the improvement of steam engines and boilers are presented herewith, for which Canadian Machinery acknowledges the courtesy of Fetherstonhaugh & Co., patent solicitors, Toronto and Montreal.

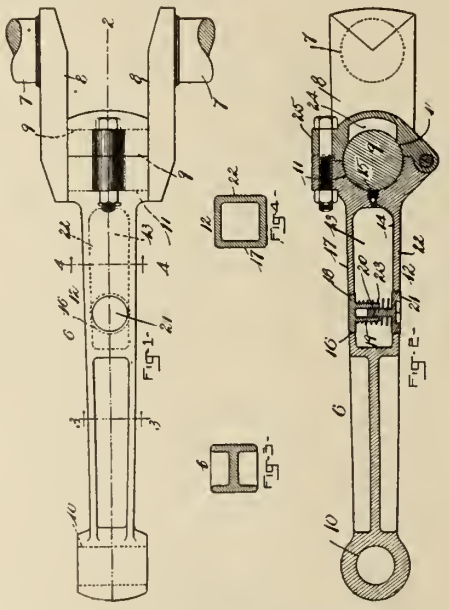
Connecting Rod for Engines.

This invention is particularly adapted to connecting rods for high speed gasoline engines. The object of the invention is to provide a connecting rod which comprises in its construction a convenient means for lubricating the crank pin of the crank shaft to which one end of said connecting rod is attached, and to this end the connecting rod is provided with a chamber adapted to contain lubricating material in solid form, such as grease, and connected by an outlet passage at one end thereof with the bearing formed in the adjacent end of said connecting rod and encircling the crank pin, and also provided with an inlet orifice constructed to enable the grease to be readily inserted in said chamber, and after being inserted means to lock the orifice through which it is inserted, so that the same cannot leak out of the chamber.

Referring to the drawings, Fig. 1 is a side elevation of a connecting rod constructed in accordance with the invention, showing the same connected to the crank pin of a crank shaft. Fig. 2 is a section, partly in elevation, taken on line 2 2 of Fig. 1. Fig. 3 is a transverse section of the connecting rod, taken on line 3 3 of Fig. 1. Fig. 4 is a transverse section of the connecting rod, taken on line 4 4 of Fig 1.

Compound Engine.

In this invention the object sought is to provide a construction of distributing mechanism for two or more cylinders in which the steam after being used in one cylinder will be returned to the valve in its passage to a second cylinder, and will thereby be subjected to a reheating action.



Connecting Rod for Engines.

In the accompanying drawings, which illustrate several embodiments of this invention, Fig. 1 is a longitudinal sectional view of a two-cylinder engine, illustrating one embodiment of the invention. Fig. 2 is a cross-sectional view of the same. Fig. 3 is a longitudinal sectional view of a three-cylinder engine embodying the invention. Fig. 4 is a cross-sectional view of the same.

Steam Boiler Superheater.

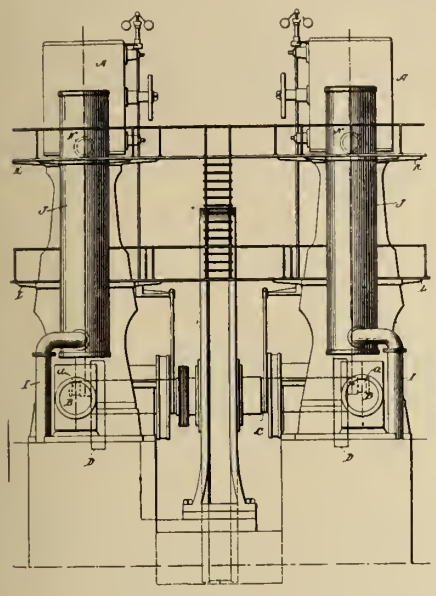
This invention relates to superheaters of the general class or type in which the superheater pipes are located in fire tubes of a steam boiler; and its object is to provide a superheating appliance of such type in which the saturated steam shall he subjected to the heat of the gases passing through the superheating tubes while traversing in reverse direction to said gases and after having been raised thereby to the maximum temperature shall be protected from loss of heat by transfer thereof to the succeeding saturated steam during its return traverse toward the steam delivery connection.

Fig. 2 shows a front view, partly in section, of slightly more than one-half of the T-head with one of the headers detached and indicated in broken lines; Fig. 3, a horizontal central section, on an enlarged scale, through one of the headers and a superheating fire tube and through the superheater pipes located in said tube; Fig. 4, a transverse section on the line a a of Fig. 3; and Figs. 5 and 6 similar sections showing the appli-

cation of a larger number of superheater pipes in each superheating tube.

Steam Engine.

This is an important invention and has been assigned to the Allis-Chalmers Co.,



Reynolds' Steam Engine.

of Chicago. It pertains to steam engines, and consists in novel combination of vertical and horizontal engines, simple or compound, and in the various features connected with the union of such vertical and horizontal engines. Among the objects sought are uniformity of turning effect, static balance of the engine in all positions, or at every point of the stroke,

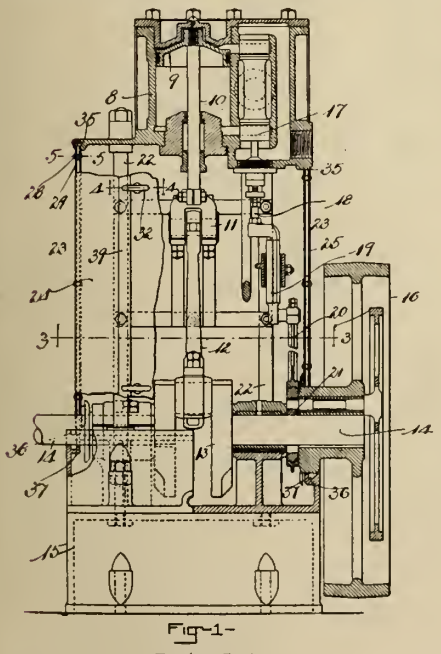
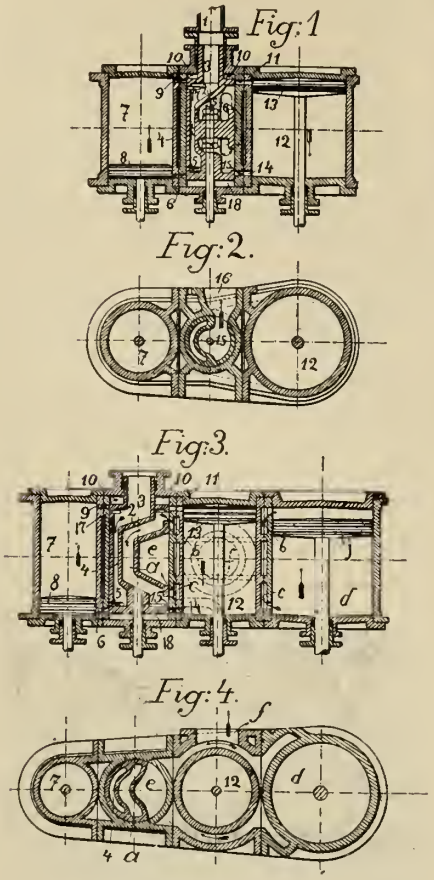


Fig-1-

Engine Casing.

facility of coupling or connecting the engine or engines to the machinery to be driven, compact and convenient arrangement of a series of such combined engines in line with each other and proper distribution of stresses.

The view given is a front or face elevation of a double compound engine constructed in accordance with the present improvements, but the application is much broader than can be shown by one view. The arrangement shown produces an extremely compact and rigid structure, and permits direct connection of both engines with the shaft. It permits the disconnecting of any one cylinder of the four in case of accident or the disconnection of one unit to allow the remaining unit to be worked at best economy when delivering half the power of the

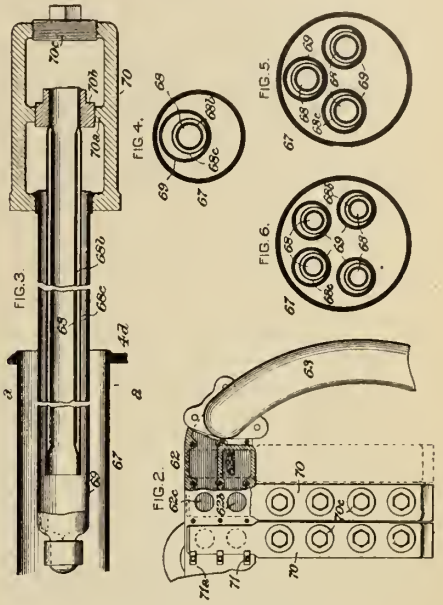


Compound Engine.

generator. It allows the concentration of great power in one shaft with but moderate power in each cylinder, which becomes very important in powers of 6,000 horse-power and upward. There are only two bearings in the shaft, which makes it much easier to keep the engines in alignment, as with the great weight of generator and fly wheel required, a certain amount of deflection in the shaft is unavoidable, which makes it extremely difficult to keep the bearings in good shape when there are more than two bearings. Finally, there are no double-throw cranks, which are always a source of expense and weakness.

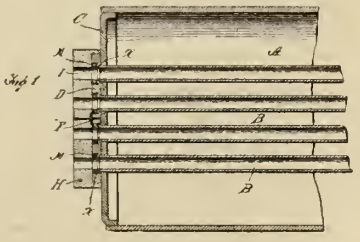
Steam Boiler.

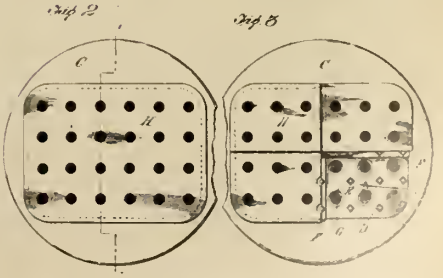
An improvement to steam boilers of the class in which fire tubes will pass hori-



Steam Boiler Superheater

zontally through the boiler, connecting at their ends to the boiler head, and the principal object is to provide a strong and durable connection between the tubes and boiler heads to protect these joints and to prevent leakage. The ends of the fire tubes in this boiler are connected to the boiler heads in the usual way, and to the rear head, next the fire box, is attached a protecting plate of improved construction. This plate is preferably





Improved Steam Boiler.

made in four sections, so that it may be more easily applied to the boiler and in order that only one section need be taken down when repairing some defective

flues. Each section of the plate is formed with holes registering with the tubes and with annular flanges around the holes adapted to register with and be calked to the annular beaded ends of the tubes outside the tube sheet. The plate is bolted to the tube sheet and may, if desired, be calked all around its edge. Preferably the plate is made in four sections, as above stated, and the joints of the sections are covered with metallic strips, which are also bolted to the tube-sheet and are preferably calked to the plates. As an additional protection, the plate is covered with a protecting wall. The wall has holes registering with the holes in the plate and the tube. The accompanying drawing, Fig. 1, shows a vertical section of a portion of a steam boiler with this improvement applied, the section being taken on a line I I of Fig. 1. Fig. 2 is an end elevation, and Fig. 3 shows an end elevation with one section of the protecting wall removed.

Engine Casing.

The inventor of this has for his object an improvement in the casing of engines whereby the oil which is attached from moving parts is confined within the casing and said moving parts are enclosed thereby in such a manner that the exterior of the engine is kept free from oil and dirt. Fig. 1 shows a side elevation, partly broken away and in section, of a steam engine with the improved casing attached.

Steel Smoke Stacks for Mills

By F. C. Douglas Wilkes, B.Sc.

(Continued from last issue.)

The stack base is then hoisted into place and securely fastened to the brickwork by its foundation bolts. Care should be taken that the base plate is perfectly square and plumb. If this is not carefully attended to the result will be that the stack is considerably out of plumb at the top. The first sheet is then hoisted into place and is temporarily though securely fastened by angles made out of bar iron ¾ by 3-inch in size. The second sheet is then hoisted into place and the two sheets are then drawn together by bolts placed temporarily through the rivet holes. The cage is not used on the first course and to facilitate the rivetting of the seams a temporary scaffolding is erected from the roof of the building or from the ground if the brickwork is separate from the building. Care should be taken that the first course is perfectly square and plumb for the same reasons mentioned above. The platform is now raised to within about 12 inches from the top of the first course and the crane support takes the place of the platform and rests on the two tie pieces from which the platform has just been taken. This crane support fits the circumference of the stack loosely but is prevented from turning by the uprights which have been added to the scaffolding to support the platform in its new position. The first sheet of the second course is now hoisted into place and fastened by bolts through the rivet holes as before. The bolts in the centre of the sheet are put into place by using a long pair of blacksmith's tongs or similar appliance. The second sheet is now put into place and the cage comes into use for the first time. This hangs from the top and rests against the last course erected which has been made perfectly stable by the rivets. The cage can easily be moved around the stack by virtue of the wheels. The man with the "dolly bar" has his place in the cage, the rivets are heated inside the stack, passed out to him and driven from the inside. To give more room for the swing of the hammers the crane mast can be lowered until it hangs from the platform by its cross piece. While the platform is being raised for the next course the forge, which would be in the way, is lifted into the cage until needed again. When the first sheet of the third course is fastened in its place by its temporary fastenings the cage is hoisted up and hung on that sheet until

III.—Top of Stack, Showing Screen.

the second sheet is in place ready for the rivets. The same procedure takes place until the stack is finished. Figure 4 shows three courses finished with the crane and cage in position. About thirty-five or forty feet up temporary guy wires are fastened to the stack by means of eye bolts through rivet holes left open for that purpose. When the stack is finished and the permanent guy wires are in place the temporary ones are removed by a man let down in a sling and the holes plugged by cold driven rivets. As the scaffolding is raised a ladder is constructed by nailing cross pieces to the uprights. The stack is then painted from the top down by a good quality of special stack paint. Ordinary paint would last about six weeks but a good stack paint will last for years.

Photo No. 3 shows the top of a stack with the screen and screen door in position. The mesh is reinforced by angle irons riveted to it on the inside.

Some stack builders put a band around the bottom of the stack but this is not a good practice as it is impossible to keep the moisture out from between the band and the stack, and this lodging there soon rusts the stack through. Because of the same reason the guy wires should be fastened to the stack with eye bolts with washers on the inside, instead of a band as is sometimes used.

THE SCALE NUISANCE.

ONE method of getting rid of old scale is to boil up and cool down a boiler once or twice with a powerful dose of soda. Mica in natural rock seems to produce a weak texture, and perhaps has that effect in the case of scale. I would like to suggest to station engineers who have scaled boilers to scrap that they should try the effect of a 10 or 20 per cent. solution of hydrochloric acid in removing scale. Probably the acid would leave the plates alone so long as any scale remained to be dissolved. If the acid does not injure an old boiler it might be then trusted in new boilers. Old scale will also come loose in time if treated with softened water. The locomotives on a railway using water from a chalk well have been cleared of scale by changing over to a well in the Tunbridge sandstone.—W. H. Booth (Proc. I.E.E.)

Practical Mechanics

By W. H. Raeburn

Article V. A descriptive discussion of an important subject, simply and clearly stated. Every article of this series should be read and studied by all readers of Canadian Machinery. They are practical and helpful.

CALCULATING SPEEDS OF GEARS AND PULLEYS.

OBJECTS in motion have more or less fascination for every beginner in the study of mechanism and many of our younger readers engaged in the machine trades are anxious to know a little about gearing—both about the arrangements necessary in order to produce desired results in movement and also about the proportions of teeth, sizes of blanks, etc. Our older readers—older in knowledge—must remember that these articles are for the beginner, and we were all beginners once, so that what appears very simple indeed to some is not too elementary for others.

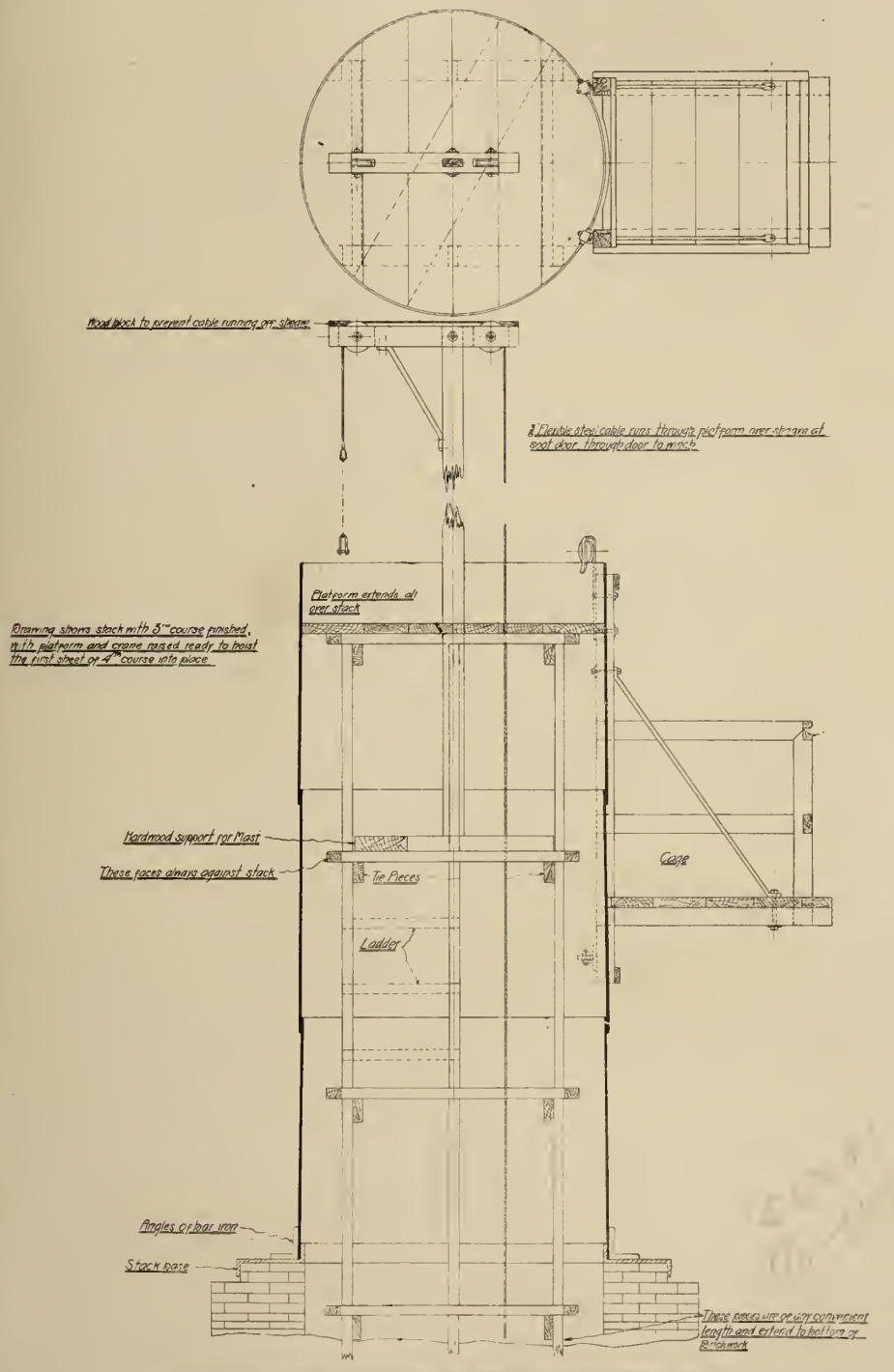

Wood block to prevent cable running off stream
Flexible steel cable runs through platform over stream at foot door, through door to winch
Platform extends all over stack
Draining storm stock with 3rd course finished, with platform and crane raised ready to hoist the first sheet of 4th course into place
Hardwood support for Mast
These pieces always against stack
Tie Pieces
Ladder
Cage
Angles or bar iron
Stack plate
These pieces are of any convenient length and extend to bottom of Brickwork

Fig 1—Method of Erecting Stacks Made of Riveted Steel Plates.

Relative Motion of Gears.

Let us briefly consider the motion of toothed wheels, or gears, as they are generally named.

In Figure 1, (A) and (B) represent two plain circular discs revolving on centres (C) and (D). These discs are in contact at (E), where there is just enough friction between them to produce motion in either one when the other is rotated.

Assume that disc (B) is revolved in the direction indicated by the arrow, then it is clear that (A) will revolve in the opposite direction. We shall now show that the revolutions of these discs in a given time will be in inverse ratio to their diameters.

To take a simple case: Let the diameter of (A) be twice that of (B); the circumferences will be in the same proportion to each other, and the distance, that is, one-third of the circumference of (B), is one-sixth of the circumference of (A), so that without complicating the matter with algebraic expressions we see that (B) will have to revolve twice to produce one revolution of (A). For any other ratio of diameter the same rule holds good, so that we can safely base all calculations for friction or toothed gearing, chain or belt drives on this — the number of revolutions of one wheel multiplied by its diameter equals the number of revolutions of the other wheel multiplied by its diameter. In the case of gears the numbers of teeth are used in place of the diameters, and it need hardly be stated that the numbers of teeth in two wheels are in direct proportion to their circumferences, which again are in direct proportion to their diameters.

We used plain cylindrical discs in our illustration, and in gearing such imaginary discs would correspond to the pitch circles, the points of the teeth being formed above or added to these circles, hence the term addendum, while the body of the disc would be cut away to allow the point of the mating gear to engage, such cutting away being great enough to give clearance. We shall consider the matter of gear teeth more fully at a later date, when the proportions of teeth, sizing of blanks, etc., will be dealt with.

In Figure 2 we have four gears used in transmitting motion and power from shaft (a) to shaft (b), the gears (B) and (C) being idlers used to fill the gap between (A) and (D), thus avoiding the

use of much larger gears on the two shafts.

If gear (A) makes 1 revolution in a given time (B) will make $1 \times \frac{20}{36} = \frac{5}{9}$ rev.; (C) will make $\frac{5}{9} \times \frac{36}{30} = \frac{2}{3}$ rev., and (D) will make $\frac{2}{3} \times \frac{30}{40} = \frac{1}{2}$ rev. in the same time.

Now, we might have omitted finding the speeds of (B) and (C), for that of (D) is the same as if it engaged directly with (A), thus: $1 \times \frac{20}{40} = \frac{1}{2}$ rev.

The arrows indicate the direction of rotation which must be kept in mind when arranging gearing. Although this is frequently called a train of gears, the term is more generally applied to the combination shown in Figure 3, which represents a train of gearing such as is used in the drive of an iron planer.

To Find Speed of Planer Table.

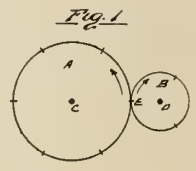
Let it be required to find at what speed the shaft (D) will have to revolve in order to move the table at the rate of 30 feet per minute.

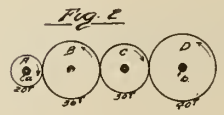
The gear that engages the rack attached to table is, as will be seen, an intermediate or idler so that we may for our present purpose consider the 16-teeth pinion on shaft (A) as gearing directly with the rack. This pinion has a circumference on the pitch circle of $16 \times 2 = 32$ in., and in order that a point on this pitch circle will move at a velocity of 30 feet or 360 in. per minute, the pinion must revolve $\frac{360}{32} = 11.25$ times per minute, thus establishing the speed of shaft (A). (B) will make $\frac{48}{16}$ times the revolutions that A makes, (C) will make $\frac{63}{18}$ times the revolutions that (B) makes, and (D) will make $\frac{64}{20}$ times the revolutions that (C) makes. We need not find the speeds of (B) and (C), but proceed as follows to find that of (D) $= 11.25 \times \frac{48}{16} \times \frac{63}{18} \times \frac{64}{20} = 189$ revolutions.

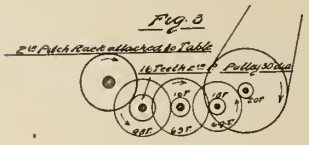
Work Being Done.

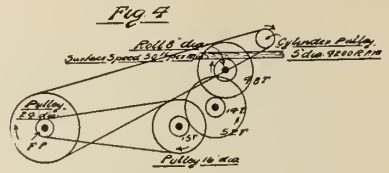
We shall apply the principle of work explained in a previous article to this problem by finding driving force acting at the table when we use a certain size of pulley and width of belt. The pulley being 30 in. diameter, its circumference in feet will be $2.5 \times 3.1416 = 7.854$ feet and as it revolves at the rate of 189 revolutions the velocity of the rim or of the belt will be $189 \times 7.854 = 1484$ feet per minute. Taking the belt as 3 inches wide with a working tension of 55 lbs. per inch of width, we have 165 lbs. for the pull of the belt and $165 \times 1484 = 244.860$ ft. pounds of work done by the belt in a minute.

If there were no loss from friction between the points of application and delivery of the power the work delivered would equal the amount just stated or the pressure exerted on the rack under the table multiplied by 30 ft. $= 244,860$ ft. lbs., so that it is clear that pressure would be $\frac{244860}{30} = 8,162$ pounds. There may be about 10 or 12 per cent. of loss









due to friction of gearing and bearings so that the actual pressure on the rack would be about 7,300 lbs.

The drive of a wood plane affords a good example for our consideration. Such a drive is represented in Figure 4, where the elements of the gearing will be recognized by those having even a slight knowledge of this class of machinery.

To Find Speed and Diameter of Pulley.

We are given the size and speed of the cylinder pulley and wish to find the speed of the countershaft on which is placed a pulley or pulleys of known size to drive the cylinder. We are also given the diameter of feed roll, the number of teeth in the feed drive gears and the diameter of the pulley on the first pinion shaft. From these we are to find the diameter of the pulley (F.P.) on the countershaft.

First we shall find the speed of the countershaft. The cylinder pulley being 5 in. diameter and its speed 4,200 revolutions per minute, we have $5 \times 4200 = 21,000$; this, as we have explained above, must equal the size of the driving pulley multiplied by its speed, so that $24 \times$ rev. of countershaft $= 21,000$; thus the required speed is $\frac{21,000}{24} = 875$ revolutions.

If this speed had been given and the diameter of pulley unknown we would have found the latter as follows: $\frac{5 \times 4200}{875} = 24$; or if both diameter and speed had been given and also the diameter of the cylinder pulley the speed of the latter would have been found thus: $\frac{24 \times 875}{5} = 4200$,

Proceeding to the feed, the circumference of a roll 8 in. diameter is $\frac{8}{12} \times 3.1416 = 2.094$ feet, so that the roll must revolve $\frac{50}{2.094}$ times a minnte in order to feed the board at the rate of 50 feet.

Taking each pair of gears as we did in the case of the iron planer, we have $\frac{50}{2.094} \times \frac{48}{14} \times \frac{52}{15} = 283.7$ revolutions the speed of the 16 in. pulley.

To find the size of the pulley (F.P.) we multiply the diameter of the large pulley by its speed and divide by the speed of the countershaft $\frac{283.7 \times 16}{875} = 5.18$ in.

In practice we would make this pulley $5\frac{1}{4}$ in. diameter, thus allowing a small margin for slippages.

In our next article we shall consider among other things the gearing on a lathe for screw cutting, a matter that should be of interest to many.

A REMEDY FOR TRAVELING MEN.

TRAVELING men, who spend a great deal of time on trains and in hotels, and who get wearied of the ordinary run of newspapers and magazines, will find The Busy Man's Magazine very refreshing. This periodical is unique in the periodical field. It is more than a magazine—it is a score of magazines all in one. Like the composite photograph of a hundred authors, The Busy Man's Magazine is a composite publication of a hundred periodicals. It culls the best from them all and presents it in an appetizing and invigorating form. Every travel-worn commercial man should try this new remedy for the weariness of the road.

Construction and Improvement

General Construction *Contractors' Supplies*

NEW CEMENT BLOCK MACHINE.

A PATENT has just been granted on the cement block machine shown in illustration for the conomic manufacture of this important accessory in building construction. The machine comprises a frame, a pivotally mounted and evenly balanced body, a forming box composed of movable members, carried by the latter; cores adapted to enter the box from the rear and a rack formed on each of these cores. A gear wheel engages this rack while a four-arm crank is pivotted centrally at the rear of the box. There are four adjustable screw rods, connected at one end on the crank and at the other end to each of the four movable box members. A hand operating lever is secured to this crank for the purpose of opening and closing the box members simultaneously. A truck mounted on a track formed on the frame is adapted to receive the contents of the box when the block is formed.

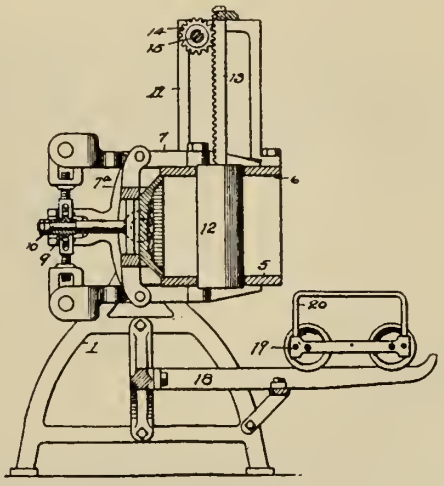
A NEW USE FOR GLASS.

LIKE reinforced concrete, reinforced glass is now more and more employed in buildings. Reinforced glass is made by rolling two sheets of glass between which is placed a metallic grating. The product shows remarkable cohesion and tenacity; and, in case of breaking, the pieces of glass, instead of separating, remain adherent, held by the metallic grating. That is the principal advantage of reinforced glass. By intersecting experiments, recently made, MM. Schlernitzauer and Crocket, of Paris, France, have proved that a plate of reinforced glass, slightly less than a quarter of an inch thick, and a trifle over four feet long by a foot and a half wide, could support a weight of about 1,047 pounds. Under 1,322 pounds it did not break, but was only bent and cracked. Reinforced glass has another important property: a small building, the walls of which are made of reinforced glass, resists a very lively fire lit on the inside; whereas an ordinary window breaks at the first touches of the flame.

Such properties clearly fit reinforced glass for roofing, shop-windows, and glass partitions; but its application to the construction of staircases is particularly successful, for glass staircases allow the easy lighting of the descents into the basements. Their steps are not slippery, and, in case of fire, their superiority over wooden staircases is incontestable.

CONCRETE AND THE STEEL BUSINESS.

WHEN concrete construction was first proposed and thorough experiments had demonstrated that it was a practical, cheap and durable building material, it gave rise to considerable apprehension on the part of steel-makers, who foresaw in its increasing use a possible substitute for steel-construction. They have since discovered, however, that to



Cement Block Machine.

a very large extent the introduction of concrete has increased rather than diminished the demand for steel. It has permitted the construction of an extensive class of structures, including mills, factories and office buildings, at a largely reduced cost compared with old methods, and in supplying the reinforcing materials for these buildings has created a market for a heavy tonnage of steel.

If every building recently constructed of concrete could with equal advantage and expense have been erected of structural steel, the maker of the latter would clearly have sustained a loss through the introduction of the new process. But this is not stating the case fairly. The reduced cost of concrete construction, the ease and promptness in securing materials, and its rapidity in working, have made possible many buildings which otherwise would not have been erected. The record of building in the last few years has been one of unprecedented growth. Every concrete structure requires a considerable amount of steel bars, as well as a goodly quantity of structural shapes. To this must be added the tremendous amount of iron and steel entering into the construction of concrete plants all over the country and into their heavy machinery and equipment.

Exactly to what extent concrete has supplanted steel and to what extent it has indirectly created a demand for iron and steel can not, of couse, be determined. But the continued advance of the iron and steel business in connection with the giant strides in the building world offers ample evidence that the steelmaker has not suffered. Rather it is that as steel reinforcement has made concrete construction possible and practical the growing use of concrete has redounded to the advantage of steel in even greater degree.

DUTY ON STRUCTURAL IRON.

BEFORE the Tariff Commission in Ottawa last month a memorial signed by the Dominion Bridge Company, the Hamilton Bridge Company, the Canada Foundry Company and the Phoenix Iron Works, was presented, suggesting that the duty on structural metal work should be specific rather than ad valorem, and that in the revision of the tariff the duty on bridges and structural metal work be made $20 per ton, which would correspond to the present rate of 35 per cent. on material valued at $2.86 per hundred pounds. It was represented that the change asked for was necessary by reason of the United States competition, the manufacturers there selling in Canada below cost at every recurring period of depression. It was also asked that the duty on small structural parts, which at present is prohibitive, be fixed at 10 per cent. This will greatly increase the use of small parts, and consequently increase the demand for larger metal work, which these companies manufacture. The total capital invested is about five and a half millions of dollars.

Our Water Power

Works at Fort Frances.

ENORMOUS power development is being pushed to completion at Fort Frances, a view of which is given on this page. The big dam, in course of construction for some time, is progressing rapidly. It is expected that by Spring large coffer-dams will have been completed and work on the power house and pulp mill commenced. It has been stated by Mr. A. W. Backus, president of the company, that in addition to power house and pulp mill a large saw mill will be erected at Fort Frances.

Falls at Fort Frances, on Rainy River, New Ontario.

Already machinery has been installed for the cement works, which when completed will give employment to over 300 men. With water power assured, which is expected to be ready for delivery in August next, there is no doubt that a large number of industries will follow and place this town amongst the leading Canadian manufacturing centres.

Another Power Company.

The Niagara-Welland Power Co., whose object is to transmit power in Western Ontario and as far as Toronto, have taken active steps to prosecute their enterprise. The company propose to tap the Welland River at a point 4½ miles from the village of Chippewa, and to construct a canal six miles to a point under the Niagara escarpment near the township line between the townships of Stamford and Thorold in the county of Welland. The citizens of Toronto and other places will no doubt be glad to hear of competing lines supplying power to their respective cities. In developing this power more of the water at present flowing over Niagara will be utilized.

Preserving Niagara.

In the February Outlook Chas. M. Dow, president of the State Reservation at Niagara Falls, N.Y., published an article of interest to both Canada and the United States. He states the various conditions under which power is being at present developed, and the amount of same, by the different companies. He calculates that at present the authorized diversion of the waters of Niagara for power purposes totals 60,000 cubic feet per second, and makes an appeal to all lovers of Niagara to take an active interest in the direction of preventing any further utilization of the Niagara waters for power purposes.

Electrical Development Co. at Niagara.

During the visit to Niagara of the Canadian Society of Civil Engineers at the time of their annual convention slips were given out containing information relating to the hydraulic power plant of the Electrical Development Co. of Ontario. They showed that the area unwatered by the coffer-dam was 11 acres, length of coffer-dam 2,200 feet, length of overflow dam 736 feet, maximum width overflow dam 33 ft. 3 in.; calculated level of water in forebay, ele. 529.5; diameter of inlet pipes or penstocks, 10 ft. 6 in.; wheel pit, 416 feet long, 22 feet wide and ele. of bottom, 388.; effective head on wheels, 135 ft.; capacity of electric cranes, 25 and 80 tons respectively; diameter of draft tubes, 9 ft.; branch tail race tunnels, length, 1,040 feet; main tail race tunnel, from intersection of branch tunnels to outlet behind falls, 1,900 feet; main tail race tunnel is of Horseshoe section, 26½ feet high and 23 feet wide; main tail race tunnel, area of water way, 452 sq. ft.; main tail race tunnel, calculated velocity of water, 26 ft. per second; 11 turbines 12,500 h.-p. capacity double runners right and left inward and parallel flow, 250 rev. per minute; 11 generators, 8,000 k.w. generate at 12,000 volts stepped up to 60,000 volts for transmission to Toronto; line, 80 miles.

ABOUT CATALOGUES

By mentioning Canadian Machinery to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

Rivets—The Parmenter & Bullock Co., Gananoque, Ont., standard lists show a wide range of these goods. 12 pages, 6 x 8 3-4.

Ratchet Drills. The Billings & Spencer Co., Hartford, Conn., are sending out a folding price list of their "Genuine Packer Ratchet Drills."

Making Projectiles. A pamphlet of the Gisholt Machine Co., Madison, Wis., describing the operations of a 24-inch Gisholt lathe in making steel projectiles. 7 1-2 x 9 1-2.

Canadian Westinghouse. Circulars No. 1127 and 1107 describe the Westinghouse automatic circuit breakers, and control apparatus and trolleys for single phase railway system.

Sawyer Man Lamps. A 28-page illustrated catalogue describing many lines of incandescent lamps manufactured by the Sawyer Man Electric Co., New York, and sold by the Westinghouse Electric Co.

Special Fans. A booklet issued by Sheldon & Sheldon, Galt, Ont., devoted to a condensed description of special asbestos fans, designed by this firm expressly for the asbestos mines of the Province of Quebec.

Hamilton Machine Tool Co. Catalogue No. 5 of the Hamilton Machine Tool Co. gives particulars about their planers and shapers. The catalogue contains 80 pages and is illustrated throughout with the finest half-tones. The corners of the pages are rounded, and the size is 9 inches by 6 inches.

Lamp Pointers. A paper by G. Brewer Griffin read before the Ohio Electric Light Association at their annual convention, issued by the Westinghouse Electric & Mfg. Co., Pittsburg. It takes up the different considerations to be gone into when purchasing series A. C. arc lamps. Twenty-six pages, 6 x 9.

Engines and Boilers. Forty-eight page catalogue, being the 15th annual issued by H. W. Petrie, Toronto, Ont., descriptive of the different classes of steam engines and boilers, handled by this firm. Each line is illustrated and described separately with full data of the dimensions and capacity thereof. Size 5 x 7.

Drills and Chucks. A neatly bound pamphlet with embossed cover, is the "bulletin" issued by the Geo. R. Rich Manufacturing Co., of Buchanan, Mich., to describe their drills and chucks. It is in the form of an essay on "Improved Machine Shop Tools and Appliances," which makes interesting reading.

Cement Bonding. The B. Greening Wire Co., Limited, have issued a catalogue descriptive of their new method of wire bonding associated with the use of concrete in building construction. This catalogue also contains information regarding wire lathing that is of interest to any in the building line. Twelve pages; size, 7 x 10.

E. W. Bliss Co. An 80-page catalogue of handy pocket size, has been issued by E. W. Bliss Co., of New York, dealing with their machinery for the manufacture of pieced tin, and black ironware. The whole is copiously illustrated, the cuts showing up finely on the coated paper which comprises the body of the book. It is full of interest for all those who are engaged in manufacturing the goods named.

Milling Machines. Catalogues of the Becker-Brainard Milling Machine Co., Hyde Park, Mass., include a catalogue of plain horizontal milling machines and universal milling machines, fully illustrated and well described. Size, 6 x 9. Another catalogue of 49 pages, describes very clearly the vertical milling machines made by this firm. In another catalogue of 98 pages is illustrated the different styles of milling cutters, besides sets of tables and complete data on car wheels, bevel gears, etc., besides weights, areas, standard sizes of high speed drills, and a wide range of other information. These may be had by application to the company mentioned. Size, 4 x 6 inches.

Beautiful Calendar. Allis-Chalmers-Bullock, Limited, Montreal, are sending out a beautifully lithographed monthly desk calendar. It is one of the best pieces of work of the year, being printed in nine colors. The great value of it, however, will be in the fact that each month the coat of arms of one of the provinces will be a feature of the card, and within the year recipient will have a complete and correct coat of arms of each province of Canada. The January card gives the coat of arms for Ontario. No doubt any reader may have a copy sent to him regularly—in fact they are well worth having—by dropping the company a postal card, stating that they are readers of Canadian Machinery.

BOOK REVIEWS.

Modern Engines and Power Generators, by Rankin Kennedy, C.E., in six volumes; $15.00 the set. Toronto: Morang & Co., publishers.

This series of volumes constitutes a practical work on prime movers and the transmission of power by steam, electricity, water and hot air. The author is already well known as the writer of several standard technical books, so that in looking forward to this work, a high standard is expected and the reader is not disappointed. The collecting of all the data, information and illustrations published in these volumes by one man was a stupendous task, but the effort has been well directed, as shown in the output. The object of the work is to explain in a most thorough manner the design and construction of modern prime movers, and to explain in detail the peculiarities of each. Besides this, it aims to go into particulars to the extent of enabling any practical engineer to understand and construct the engine, boiler, etc., from the description given, as well as to enable him to estimate in each case the costs of producing power under the different systems and circumstances. As well as the prime movers, the different methods of transmitting the power from the prime mover to the work to be done are discussed.

One of the pleasing features in connection with this book, inasmuch as it is designed to be practical, is its simplicity that enables one to read it without a particular knowledge of mathematical mechanics or thermodynamics. Besides taking up the construction, the author explains thoroughly the working of the different engines. The part relating to gas generators and gas plants is particularly valuable. To go into a review of these six volumes would be impossible, but it might be mentioned that for anyone in the engineering profession or in the mechanical trade, who would become more intimate with the different prime movers in which he comes in contact, these volumes should prove a veritable encyclopedia.

At the Noon Hour

He Was Fired.

A builder in Pennsylvania, having heard that the men did not start work at the proper time, thought he would drop down about 6.30 one morning and see. Going up to the yard he caught sight of a joiner standing smoking, with

If you are grouchy, here is what you are coming to. This man grumbled about poor tools, his meals, the weather. This became chronic until he is a misfit in the universe.

his kit not even opened. Simply asking his name, which he found to be Jake Robertson, he called him into the office, and handing him four days' pay told him to leave at once.

After having seen the man clear of the yard, he went up to the foreman and told him he had made an example of Jake Robertson by paying him off for not starting to work at the proper hour.

"Jumping Jupiter," ejaculated the foreman, "that chap was only looking for a job."—N. Y. World.

Reason of Boycott.

Of an Irishman on the sidewalk stating to passersby that the corner grocery was boycotted by the union, one of them asked the reason of the boycott. "Well," said the Irishman, scratching his head, "I don't know exactly how it is, but it is about like this : Hogan—Hogan keeps the grocery—Hogan had a partition built in his store and he got a carpenter to build it that bought a new saw from that old white-haired duffer that rides around in the carriage, and the old white-haired duffer's coachman that rides around with him in the carriage had took his collars to a laundry that hired a non-union painter to put in new glass where the window had been broken. So they boycotted Hogan's grocery."—Fuel.

His Not to Reason Why.

The inefficiency of Mexican labor was under discussion by a group of mining promoters.

"On my last trip to Mexico," said one, "while our train halted at Jimulco, a dinner station on the Mexican Central, I alighted and watched the mechanic who went from car to car sounding the wheels with a hammer, presumably to test their condition. He was a fair type of a native 'skilled workman.' Just to draw him out a little, I inquired—

" 'Why do you rap the wheels ?'

"Setting down his torch, he stared at me in amazement. 'Because the master mechanic tells me to,' he replied.

" 'But, why ?' I persisted. 'What good does it do ?'

" 'I do not know, senor,' said he. 'The master mechanic tells me to strike each wheel, and I do so. That is enough for me.'

" 'How long have you been working at this job ?' I asked.

" 'Two years,' he replied. For two years he had been going through the form of sounding the car wheels, without the slightest knowledge of the object of the test or the slightest curiosity concerning it !"—Philadelphia Record.

At Home.

The Latest Shade—When on earth I was an automobilist.

His Satanic Majesty—Ah ! Then please be kind enough to crawl under that furnace and see what's the matter with the grate ; it seems to be klinked up.—Ex.

Honesty's Vacation.

Diogenes was reflecting. His quest for an honest man had failed. Suddenly his face brightened.

"Well, that's one on me," he said. "I might have known that between the investigations of insurance and of oil they'd all be driven out of town."

"'Tis easy enough to be pleasant
When life rolls on like a song ;
But the man worth while is the man who can smile
When everything goes dead wrong."

Putting a fresh candle in his lantern he started for the tall timber.—News.

Tricks of the Trade.

Everybody is invited to contribute to this page. Send in your ideas, odd jobs you are doing, and anything of interest to fellow-workmen. Remuneration will be made for such contributions. [Ed.]

Novel Gear Cutting.

HAVING occasion to cut an irregular box cam without being particularly prepared for such a job, a novel means was adopted for effecting this, with the aid of an air drill, as will be seen from the illustration. The cam itself, it may be noticed, is so fashioned

The Finished Cam.

that at one point the groove is located very close to the centre of the gear, while it runs close to the rim at another point, hence it could not be cut with a single tool, it being absolutely necessary that the groove of the cam be parallel.

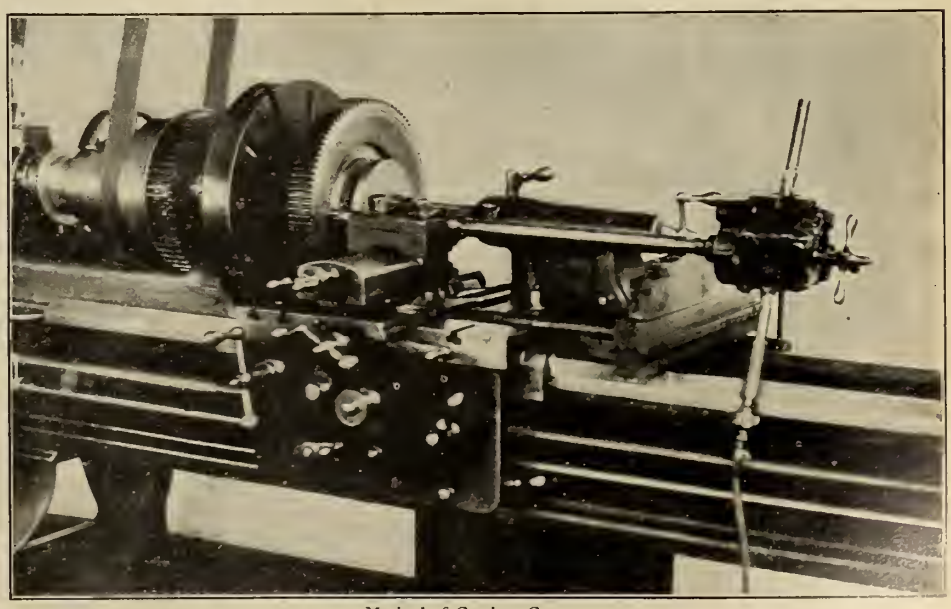
The method devised, in lieu of the particular apparatus necessary, and which turned out particularly successful in this emergency, consisted of a block mounted on the slide of engine lathe in which a milling cutter was free to revolve. A master cam was attached to mandrel with gear in proper relation to it ; as the lathe revolved slowly (the slide rest having previously been disconnected from the cross feed screw) the milling cutter was kept in contact with the master cam by means of a weight fastened to the end of cross feed slide. The cutter arbor in contact with the master cam was the same diameter as the milling cutter used ; this insured an absolutely parallel slot. A pneumatic drill was used for driving the cutter. This arrangement proved to be a satisfactory one in every respect, as the speed could be controlled to a nicety. It made the fixture at minimum cost, no cumbersome belts or other complicated mechanism being necessary and the set up required no more time than an ordinary chucking job.—Henry J. Kimman, superintendent of the Cleveland plant, Chicago Pneumatic Tool Co.

Something to Invent.

It is not an uncommon occurrence to hear a mechanic remark that "if he could only think of something to invent he would soon jump his overalls and leave that class of work for some one else to do."

It appears to me that such a person is trying to jump from the bottom to the top of the ladder without climbing its intermediate steps or trying to grasp from futurity something that is not meant for this stage of the world's history. There is an old saying, ;'Necessity is the mother of invention." It seems to me absurd for a person to invent some new contrivance and then have to look for something to apply it to.

There are any number of places where he could begin, the most of which are so common and simple that for that very reason they are usually overlooked. Take for instance the efficiency of our common steam engines, ranging from 60 to 80 per cent. Does it ever cross his mind that there is room for improvement there ? He may say that it has got to have bearings large enough to withstand the greatest strain or that it has to have a piston with stroke and area enough to do the work. These facts are quite true, but are there no ways of improving the condition and thus raise the efficiency of the engine ? — no more effective method of lubricating those bearings and cylinder or no better



Method of Cutting Cam.

contrivance than the present form of piston with its stiff rings pressing hard against the walls of the cylinder ? He may say, "That is so. I never thought of that." I therefore think it would be a good idea to urge the readers of Canadian Machinery to follow more in detail the steady progress that is being made in improving what we have already got and to expend their time and brains on a class of work that lies within the range of their ability.—G. P. Johnston, Hamilton.

To Clean a File.

Those who have had to file any of the softer alloys of aluminum know what a clinging and leady substance it is under the file. In the opinion of many it is the worst stock to file, without exception, of commercial metals, and files clogged with aluminum are difficult to clean with the scratch brush. The writer has found that an ordinary file stuck up with aluminum can be readily cleaned with the brush by first dipping the file for a few minutes in a rather strong solution of caustic potash or soda lye, or failing this a smear of soft soap, which usually contains an excess of potash. It may be explained that the caustic alkalies have a strong affinity for metallic aluminum, evolving hydrogen and forming aluminates, allied to clay.

In France they have on the market a special file with a tooth expressly designed for soft alloys and gun metal, which partakes somewhat of the same clogging nature, and the tendency to roll up "pin heads." It is said these special cut files save much time and do better work in factories especially devoted to working such metals, but in ordinary jobbing practice a knowledge of this weak spot of aluminum serves as well, and should be added to the list of "shop kinks" that fill up the trade of every tried and capable machinist. — C. J. Stuart, Montreal.

Power and Transmission

Steam Gas Electricity Compressed Air Water

IMPROVEMENTS IN THE ROBB-ARMSTRONG ENGINE.

IN order to keep abreast with the improvements in machine building that have been developed in recent years, the Robb Engineering Co., Limited, of Amherst, Nova Scotia, is constantly bettering the design of its product, retaining the good features of the older engines and adding numerous improvements suggested by accumulated experience in the work. The accompanying illustration shows the general design and construction of a medium speed Corliss type of engine, which is a single cylinder, Corliss, of the heavy duty type, with outboard bearing on an independent pedestal. The frame has great strength and rigidity, and this is obtained by a careful disposition of the metal and by the use of liberal thickness where weight is of benefit. It is averred that under the heaviest load, there is no evidence of strain.

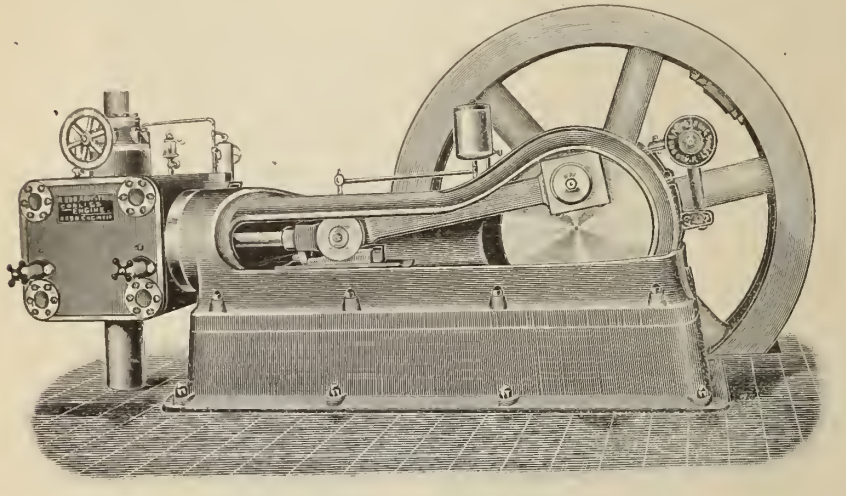


Fig. 1 Medium Speed Heavy Duty Robb-Armstrong Engine

These Corliss engines are built in two types, known as the medium speed, heavy duty type, and the slow speed, known as type F. The latter engine embodies all the features of the former, but is of longer stroke and designed for slower speed.

The special features of the Robb-Armstrong engines are the Armstrong Corliss valve gear, which is more simple in construction than the ordinary releasing gear, and will operate successfully for any speed up to 200 revolutions per minute. By the introduction of two small links between the wrist plate and bell cranks, the steam valves are caused to open and close quickly and remain stationary during the remainder of the stroke, the action of the valves and steam distribution being almost precisely the same as the releasing gear invented by Mr. George H. Corliss, the advantage being that as the Armstrong gear is positively driven, and does not depend on springs or dash pots used in the ordinary Corliss valve gear, it may be operated at much higher speed than the releasing gear, and as there are only about half as many pieces and wearing surfaces, and no latches or detachable parts, and as all the parts, with the exception of the bell cranks, are encased in oil, the gear runs very smoothly without noise, friction or wear. The valves are of the usual Corliss rotative type, but of the latest design, partially balanced and triple ported, giving very short travel and quick opening. The exhaust valves are driven from a wrist plate in the usual way.

The governor, Fig. 2, is the Robb-Armstrong-Sweet design, the centrifugal weight being carried directly by a spring, so that the heavy strain due to centrifugal force is not brought on the suspension pin, which merely carries the ec-

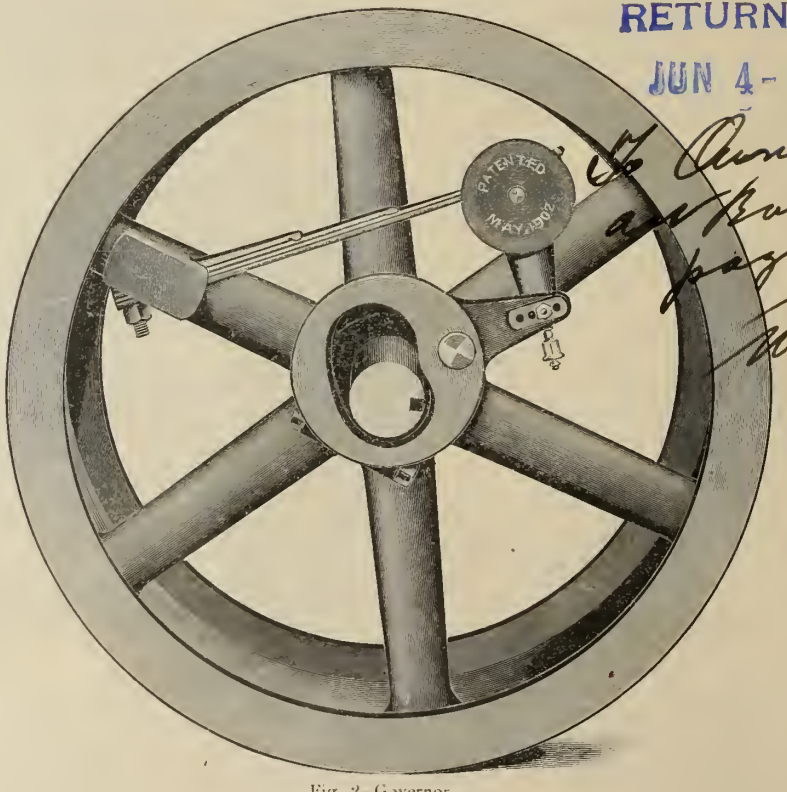


Fig. 2 Governor.

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JUN 4 - 1906

eentric, and is not subject to any strain or friction except that due to driving the valve gear. The governor system is in gravity balance in all positions, be-

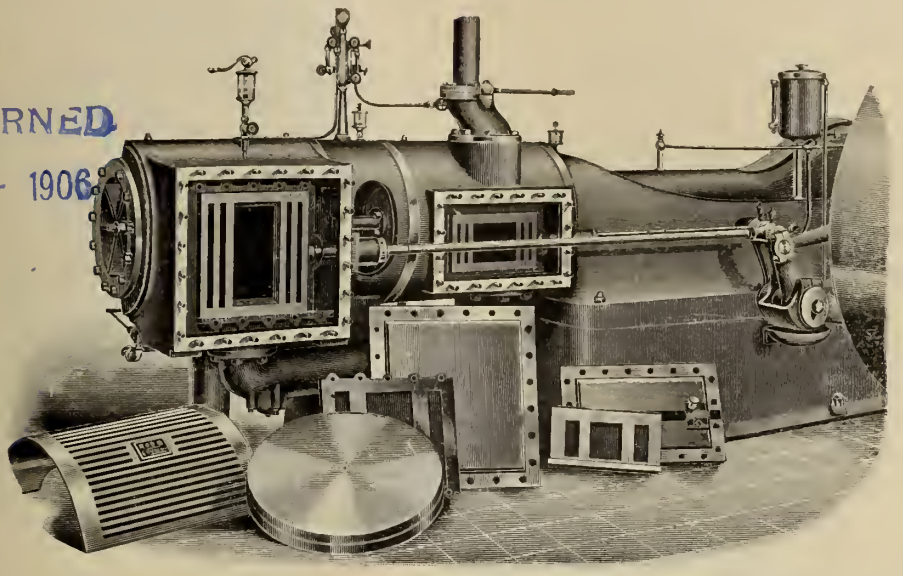

Fig. 3—Robb-Armstrong Engine, showing valve seat.

cause the eccentrie is made to balance the centrifugal weight, this principle being the same as that used by Professor John E. Sweet in the governor of his straight line engines. The speed is raised or lowered by ehanging the tension of the spring, and the sensitiveness is controlled by moving the liuk which eonnects the weight and the eccentric in or out, along the row of holes provided for that purpose. This governor can be made to regulate so accurately through a large range and with so little friction, that it is especially recommended for engines driving alternating current generators in parallel. All the working bearings are oiled by a forced-feed system. This system consists of a pump which is attached to the eccentric, driven from the crank pin. The pump is located in the crank pit, which is made deep and used as an oil reservoir, the oil returning to the crank pit from a filter, whence it is pumped back to the bearings, thus supplying a continuous circulation of oil.

The pump is simplicity itself, as there are no valves, stuffing boxes or other objectionable features which are liable to get out of order and clog. It consists merely of a steel plunger, which fits into a brass sleeve and oscillates. In the larger engines, the pump is made of sufficient size to keep a constant pressure of from 12 to 15 pounds on the bearings. A small pressure gauge is provided. This system has the advantage over the gravity system, and also the splash system, that it keeps a continuous, positive, forced feed eirculation of oil in all the bearings. Experienee with high speed engines of British manufacture demonstrated that with this system, of forced lubrication, an engine will run continuously with practically no wear and absolutely noiseless.

The parts covered by the foregoing description are practically alike for all sizes of engines, with the exception of the high speed and smaller engines, in which the Sweet balanced valve is used. The valve seat in the cylinders, Fig. 3, the pressure plate, and the distance strip are accurately finished. In this valve, practically the only wear is downward. These engines, both of the single valve and four valve types are built either vertical or horizontal, simple or compound. Figs. 4 and 5 are recent installations of Robb-Armstrong engines in Canadian power houses.

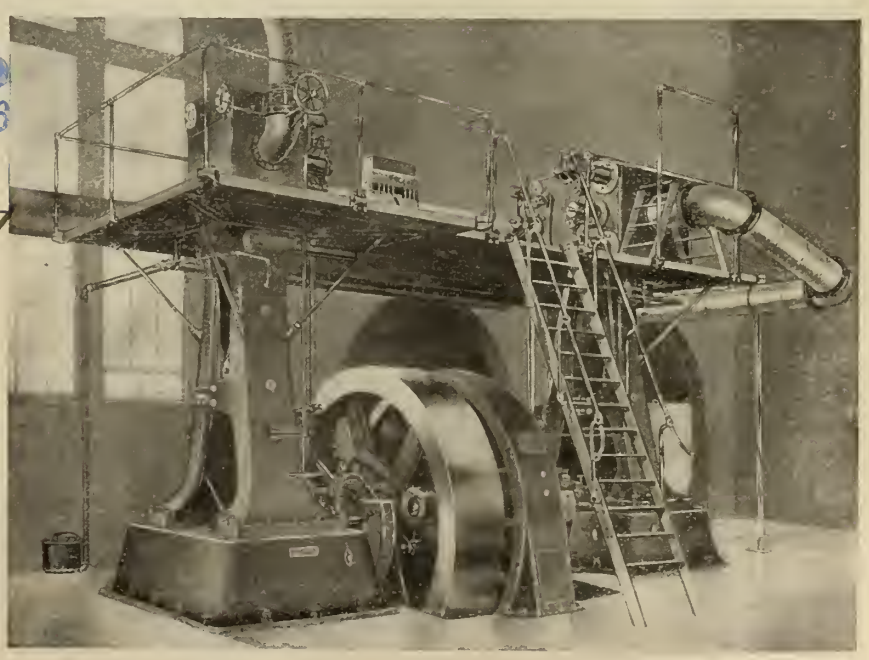

Fig. 4.

A LARGE STEAM TURBINE GENERATOR.

ACCORDING to B. A. Behrend, chief electrical engineer of the Allis-Chalmers Co., a generator of 5,500 k.w., direct connected to a steam turbine, was recently tested at the Bullock works, at Cincinnati, of the Allis-Chalmers Co. This machine and its performanee are interesting on account of numerous novel features, as well as on account of the high efficiency, perfect regulation, and low temperature, which have been brought out by tests. Although the normal rated eapaeity of this generator is 5,500 k.w., at either 6,600 or 11,000 volts, the generator must be capable of standing 6,880 k.w. continuously without rising more than 45 degrees C., and 8,250 k.w. for three hours without rising more than 55 degrees C. On the overload this generator, therefore, will require a prime mover developing 11,500 h.p.

The current developed by this machine has 25 periods, is three-phase, and is generated by a 4-pole magnetie field turning at 750 revolutions per minute. Fig. 1 shows the stationary eore or armature, and Fig. 2 the rotating element. Fig. 1 gives a good view of the thorough lamination and division of the stator core for the purpose of ventila-

tion and cooling, while Fig. 2 shows the most interesting part of the machine, namely, the rotating field. When we stop to consider that the peripheral speed of the surface of this rotating field is almost 15,000 feet per minute, we realize that we have before us a problem taxing the designing ability of the engineer to the utmost. If we could proceed, either on railroads or on the ocean, at such speeds as this, we should travel from New York to London in approximately 17 hours. Under such conditions of speed the centrifugal force assumes tremendous magnitude; and the careful distribution and calculation of the stresses and strains in the different members of the rotating magnetic field become a matter of the utmost importance and seriousness. The bursting of a mass of steel, of 75,000 pounds, rotating at the rate of 3 miles per minute, would produce very disastrous effects, and the responsibility of the designer and builder of such machines is, therefore, a very grave matter.

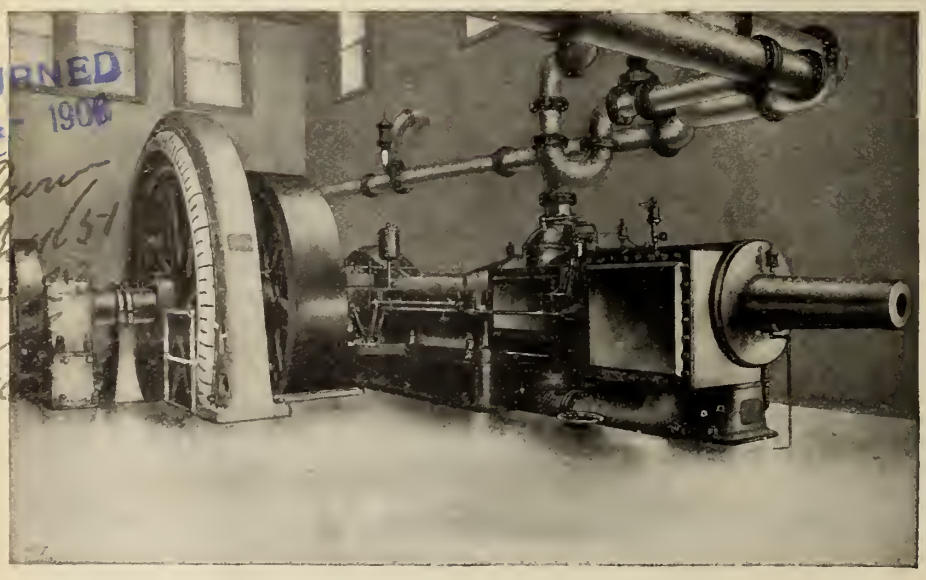

Fig. 5.

A careful investigation in regard to the stresses and strains produced in rotating discs under the influence of centrifugal force was carried out by the writer several years ago, theoretically as well as experimentally, and it brought forth the interesting result that, in a plain rotating disc, the stresses are a maximum on the inside boundary of the disc, and a minimum on the outside boundary. These results, obtained by mathematical analysis, were borne out by experiments on lead discs, the distortion of which was carefully studied by measuring the discs before the speed tests and after, and the distortion corroborated the correctness of the theoretical conclusions. Rotating discs, therefore, really do "burst" when they go to pieces, that is, they explode in such a manner that they are rent to pieces by forces which tear the fibre of the material, first on the inside, the rents rapidly being transmitted to the outside. This investigation is of considerable interest with regard to the bursting of emery wheels and grindstones, and it throws much light upon the proper and economical design of wheels of any kind, rotating at high speeds. With the aid of the data obtained through these theoretical and experimental investigations, the foundation of design of the rotating elements of these large machines has become well secured, and the determination of the maximum internal stresses in the nickel-steel plates composing the rotating field, illustrated in Fig. 2, can be made with considerable confidence. The structure of the rotating field consists of ten nickel-steel forgings pressed on a nickel-steel shaft. In order to obtain both high magnetic permeability and good mechanical strength, nickel-steel, containing approximately from 3 to 5 per cent. nickel, has been used whose lowest elastic limit is 50,000 pounds per square inch, and whose lowest ultimate strength is 80,000 pounds per square inch. The highest stress existing in any one part of the rotating element does not exceed 15,000 pounds per square inch. At normal speed, therefore, the lowest safety factor is almost 5½, showing that these rotating fields might be run at twice their normal speed without flying asunder.

A problem of extreme difficulty confronts the designer in placing and securely fastening the field windings to these large steel blocks in such a manner that neither the copper conductors nor the insulation between them and the magnetic field can be injured by the centrifugal force to which they are exposed. To this end flat copper strips have been wound on specially designed formers, which are made in such a manner as to give an ever-increasing opening to each successive turn, and they are lodged in radial slots, milled into the nickel-steel discs, and held in place by retaining wedges made from Parsons manganese bronze. The construction is so solid that it might well be said that a cannon could not be made stronger and more reliable. The end connections of the field coils rest against nickel-steel end rings, which also are shown in Fig. 2.

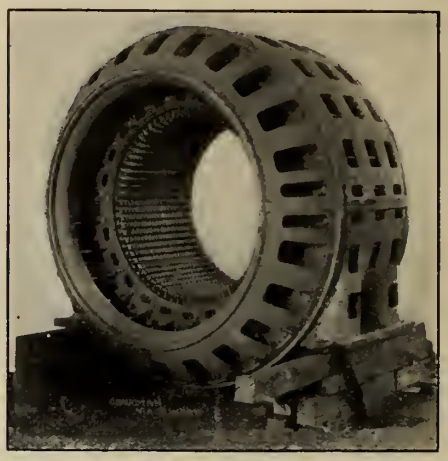

Fig. 1—Stationary Core or Armature.

The electrical efficiency of this generator, as actually obtained from tests, is 94.4 per cent. at ¼ load; 97 per cent. at ½ load; 97.9 per cent. at ¾ load; 98.3 per cent. at full load; 98.5 per cent. at 1¼ load, and 98.6 per cent. at 1½ load. The regulation of the generator at full load at 100 per cent. power factor is 7½ per cent., and yet the generator has enough margin to give its full rated output on any power factor, however low.

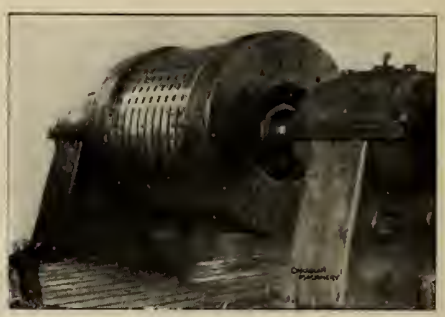

Fig. 2—The Rotating Element.

'TWAS A SHELDON SYSTEM.

In the write-up of the Davidson & Thackray plant in last issue it was mentioned that the dry kiln was operated by the Sturtevant fan system. This was published in good faith as the in-

formation was secured first-hand at the works being described. However, it should have read Sheldon & Sheldon, as this firm designed the entire drying systems for the kilns, which are the largest of their kind in Canada.

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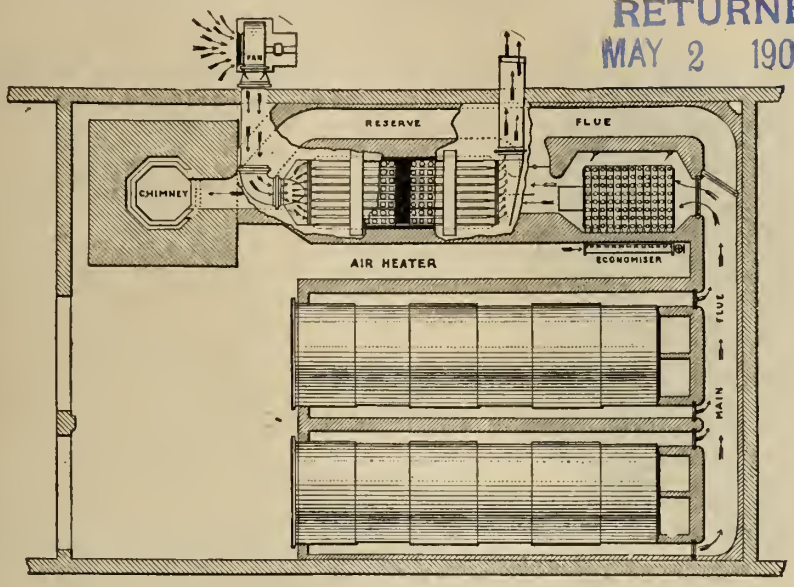
MAY 2 1906



Plan of Green Air Heater and Economizer Installation.

THE GREEN AIR HEATER.

AN air heater has recently been developed by the Green Fuel Economizer Co. similar in many respects to the economizer and installed after the same manner. Air is drawn in at the top by means of a fan and forced first down through one set of tubes, up through another set, then down, and so on until it leaves the heater to be distributed by pipes to drying chambers, and other places in which the heated air is used.

The tubes are of cast iron and are nine feet long between the headers and have an internal diameter of 3⅞ inches. They are hydraulically pressed into top and bottom boxes which are of sloping design, in order to insure uniform velocity and distribution of the air in passing from one set of tubes to the next. The air moves through the tubes at a high rate of speed, and by the frequent redistribution to the tubes all possibility of short-circuiting or eddying is eliminated. This results in a high efficiency of the heating surface. Separate top and bottom boxes are provided for each row of tubes, so that any number of rows may be set up together for any capacity of plant or any gases pass into the chimney, while the heated air is taken out at the end nearest the boiler, where the flue gases are at their highest temperature. This causes a uniform difference of temperature to be maintained between the flue gases and the air in the tubes. The air heater may be combined with the economizer and a test made on a plant of this kind, which contained 144 economizer tubes and 72 heater tubes, gave the following results :

Temperature of gases entering economizer, 460 deg. F.

Temperature of gases entering air heater, 301 deg. F.

Temperature of gases leaving air heater, 257 deg. F.

Temperature of water entering economizer, 112 deg. F.

Temperature of water leaving economizer, 248 deg. F.

Temperature of air entering air heater, 70 deg. F.

Temperature of air leaving air heater, 152 deg. F.

It will be noted that the air left the heater at the temperature of 152 degrees F. Air at this temperature will take up nearly 0.01 pound of water per cubic foot, making it very effective for drying purposes.

This heater will replace steam heater coils for drying, thereby saving as much steam as will be required for drying and the corresponding amount of fuel, also relieving the boiler plant of this demand for steam. It thereby increases, by this amount, the capacity of the plant.

USEFULNESS OF GRAPHITE.

GRAPHITE is one of the purest forms in which carbon occurs in nature. It is bright in lustre, soft and smooth. It is not affected by heat or cold, and is not acted upon by acids or alkalies.

It occurs naturally in two forms, the flake (or foliated) and amorphous. Comparing the one with the other there is a vast difference in nature, texture, action and effect. In the first place "flake" graphite is not adhesive, and adhesiveness is absolutely essential as an efficient lubricant.

The ideal lubricant should get at the cause of friction. Friction is due to the roughness and unevenness of the surfaces in contact. And this friction, of course, means wasted energy that, instead of being utilized as power, is absorbed as heat. No matter how smooth the surface may appear to the naked eye, it will always prove to be rough and full of inequalities when examined under the microscope. To effectively overcome this friction, to permanently fill up all the minute roughness of the metal surfaces, and utilize the wasted

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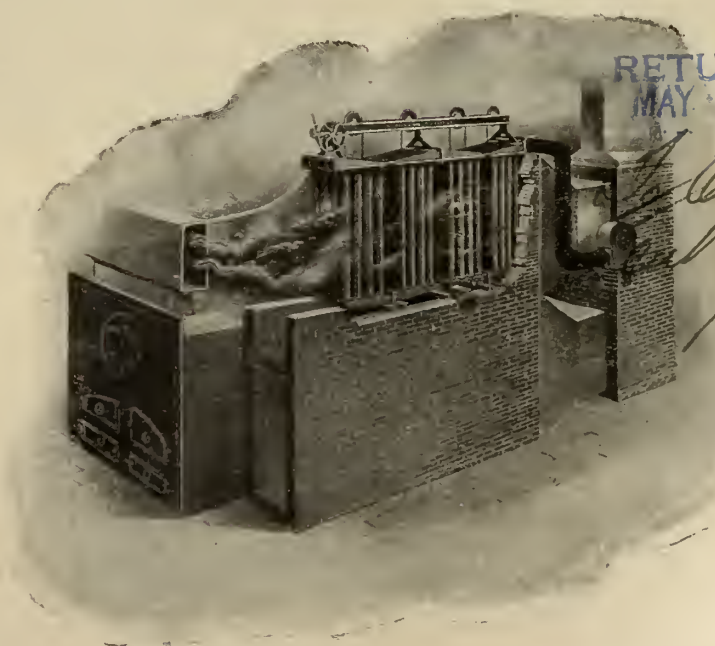
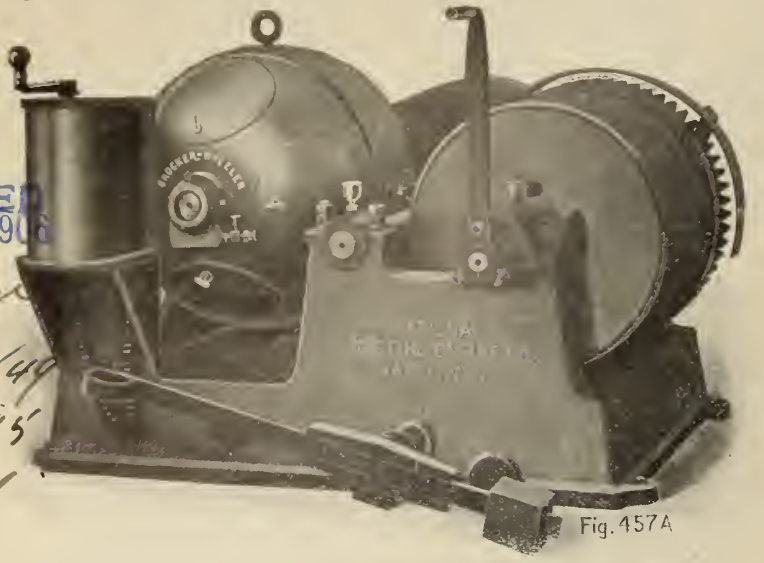
MAY 2 1906



Installation Comprising Green Air Heater and Green Fuel Economizer.

power, a substantial lubricant is required.

Canada's new lubricating graphite is an impalpable, "air-floated" powder—atoms rather than flakes—with its natural affinity to fluids, readily mixes with oil, and remains in almost perfect suspension, resulting in the increased efficiency and life of the oil. A thinner and cheaper oil may be used, and the consumption reduced at least one-fourth, and in many cases one-third, thus making a great saving in cost of lubricating materials, at the same time securing absolute freedom from hot bearings. It is manufactured by the Economical Supply Co., 173 Queen street east, Toronto.



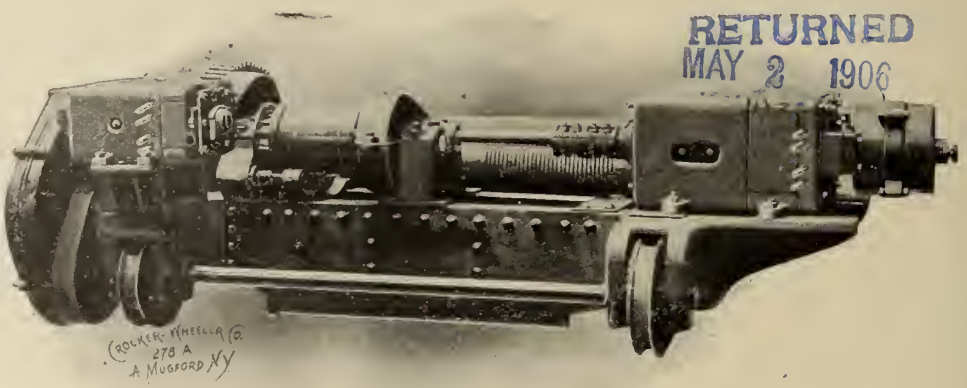
rocker-Wheeler Standard Electric Hoist.

ELECTRIC HOISTING MACHINERY.

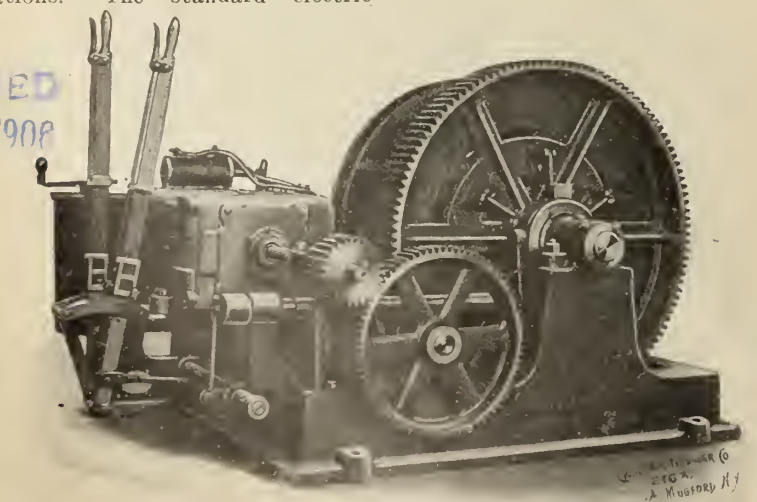
SOME of the adaptations of the Crocker-Wheeler motors to hoisting machinery are shown in three illustrations. The standard electric hoist is provided with a winding drum driven by the motor through a double run of spur gearing. This drum is free to revolve on the shaft, but is thrown into engagement with the gearing by means of a friction clutch operated by a hand lever. When the drum is disengaged from the clutch, its motion may be regulated or stopped by means of a band brake operated by a foot lever.

The motor is operated by a reversible drum controller, providing twelve or more speeds in either direction, and the location of the controller handle, foot lever and friction lever, is such as to place them all within convenient reach of the operator. The motor is of the fully enclosed I type, having a compound winding especially suited to this class of work.

In operation, the motor may be run continuously and the motion of the drum controlled by means of the friction clutch and band brake, or when the class of service demands, the friction clutch may be engaged and the motion of the drum regulated by the controller.



Crocker-Wheeler Motors Operating Traveling Crane.



Motor Operating Prospecting Hoist.

MECHANICAL DRAFT.

THE advantages of mechanical draft are thus presented in the new work on "Smoke Abatement," by Wm. Nicholson :

"1. If the boilers are well constructed and are provided with ample room to insure circulation, their steaming power may, without injury, be increased to 30 per cent. over that obtained by the natural draft for continuous working. 2. Such augmentation is accompanied in normal cases by an increased consumption per indicated horse power. 3. It enables an inferior fuel to be used. 4. Under certain conditions of weather it would be difficult to maintain steam with natural draft, but with forced draft the power is insured. 5. Much thicker fires can be worked than with natural draft, causing the air to travel through incandescent fuel, with more time to give up its oxygen, while the intensity of the draft through the incandescent fuel causes a more intimate mixing of the air with it than is possible with ordinary chimney draft."

ENGINEERING NEWS

AND SOCIETY NOTES

SOCIETY OFFICERS.

Canadian Mining Institute.

President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer Lamb, Victoria, B.C.; treasurer, J. Stevenson Brown, Montreal.

Toronto Branch A. I. E. E.

Chairman, H. A. Moore; vice-chairman, R. G. Black; secretary, R. T. McKeen.

Marine Engineers.

Grand president, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N.B.

Engineers' Society, Faculty Applied Science, Toronto University.

President, T. R. Loudon; recording secretary, F. A. McGivern; treasurer, B. W. Marrs; corresponding secretary, C. S. Shirriss.

Canadian Electrical Association.

President, A. A. Wright, M.P., Renfrew, Ont; vice-presidents, R. G. Black, Toronto, John Murphy, Ottawa; secretary-treasurer, C. H. Mortimer, Confederation Life Building, Toronto.

Canadian Association of Stationary Engineers.

President, Wm A. Sweet, Hamilton; vice-president, Jos. Ironsides; secretary, Wm. Outhwaite, Toronto, conductor, Ed. Grandbois, Chatham; doorkeeper, Chas. Kelly, Chatham.

Ontario Association of Stationary Engineers.

President, Geo. Fowler, Toronto; vice-president, W. F. Chapman, Brockville; treasurer, Charles Moseley, Toronto; registrar, W. G. Blackgrove, Toronto.

Canadian Railway Club.

President, S. King; secretary, James Powell, chief draughtsman motive power department, G. T. R. treasurer, S. S. Underwood, chief draughtsman car department, G. T. R.

Engineers' Club of Toronto.

President, F. L. Sommerville; treasurer, W. J. Bowers; secretary, Willis Chipman, Rooms 96 King St. W.

Canadian Society of Civil Engineers.

President, H. D. Lumsden, Ottawa; vice-presidents, M. J. Butler, Ottawa; C. B. Smith, Toronto; W. M. Walbank, Montreal; secretary-treasurer, not yet appointed. Rooms, 877 Dorchester street, Montreal.

CIVIL ENGINEERS' ANNUAL CONVENTION.

FOR the first time in its history the Canadian Society of Civil Engineers held its annual convention outside of Montreal, where the headquarters of the society are situated, the occasion being the twentieth annual gathering which was held at the King Edward Hotel, Toronto. A Toronto branch of the Canadian society has been proposed, and some strong sentiment in the direction of such a proposal expressed.

Canadian Society of Civil Engineers' Twentieth Annual Convention at Niagara Falls, Wednesday, Jan. 31st, 1906

The convention lasted four days, from January 30 to February 2 inclusive.

The ballot resulted in the following officers being elected: President, H. D. Lumsden, Ottawa; vice-presidents, M. J. Butler, of Ottawa, C. B. Smith, of Toronto, and W. M. Walbank, of Montreal; councillors, W. F. Tye, of Montreal; John Galbraith, of Toronto; Duncan Macpherson, of Ottawa; Phelps Johnson, of Montreal; W. H. MacLeod, of Winnipeg; G. H. Webster, of Manitoba; R. McColl, of Halifax; H. Holgate, of Montreal; John Kennedy, of Montreal; C. Fergie, of Sydney, C.B.; E. A. Hoare, of Quebec; J. S. Dennis, of Calgary; E. Mohun, of Vancouver; R. A. Ross, of Montreal; L. A. Herdt, of Montreal; R. J. Durley, J. E. Hardman, J. B. Porter, and J. G. G. Kerry, of Montreal.

A strong plea was made to the Dominion Government for more effective survey work being carried on in the different departments of the Government. Among the papers read at the different meetings were: "Diamond Mining at Kimberley, South Africa," by Prof. J. B. Porter, of Montreal; "Hydraulic Locks on the Trent Canal," by W. J. Francis, of Peterboro; "Experience with Conduits in Toronto, with Notes on the Laying of a 6-foot Steel Pipe," by C. L. Fellowes of Toronto. A paper, "Tide Levels and Datum Planes on the Pacific Coast of Canada," by Dr. Dawson, of Ottawa, was presented but time did not permit of its reading. The presidential address by E. Marceau, of Montreal, was on the subject of "The Origin of Our Canal System," being an interesting account of the different canals in Canada. One of the most pleasant features of the convention was a visit to Niagara Falls on a special train provided by the Grand Trunk Railway, where the society were the guests of the Ontario Niagara Power Co. The latter entertained the members to an elaborate banquet in their transformer station, which was beautifully decorated, the entire menu course having been cooked by electricity. During the day visits were made to the different power stations and the various developments inspected. On the last day of the convention the members visited in groups the transformer station of the Toronto & Niagara Power Co., Polson Iron Works, Canadian Shipbuilding Co., Toronto city pumping station, street railway power house, Electric Light Co., Consumers' Gas Co. and the Canada Foundry Co. At the latter place the members were banqueted by the officials of the company.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

PONY BAND SAW.

SINCE placing their first band saw on the market the Waterous Engine Works Co., of Brantford, have made important improvements and such additions as were found would make it not only a first-class band mill but would give it qualities as to actually render it capable of cutting as much or more than the large eight-foot band mill on small logs.

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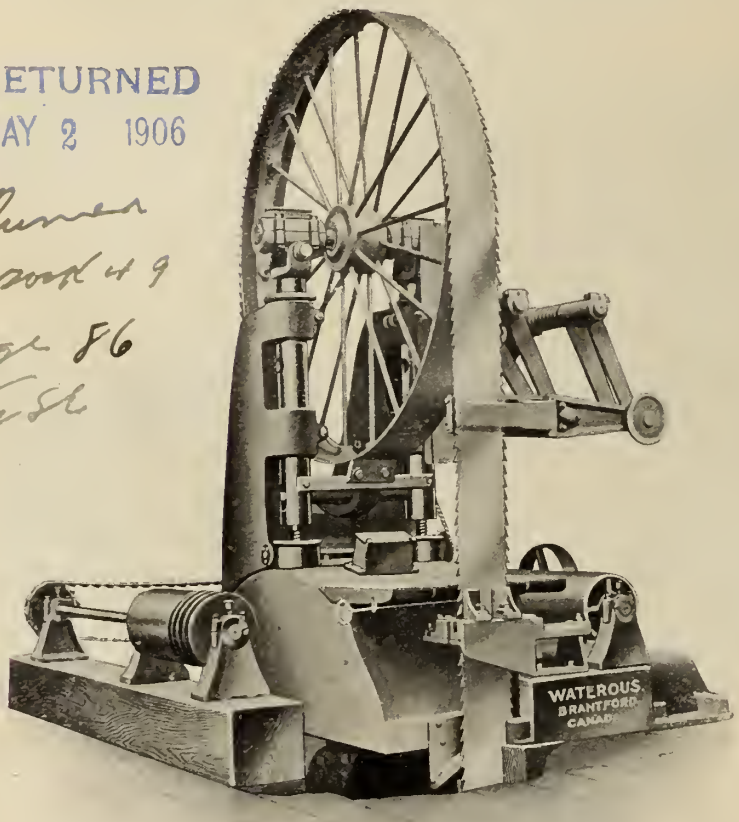
MAY 2 1906



Waterous Pony Band Saw.

The mill is being used for cutting pine, basswood, cottonwood and all classes of hard wood, both here and abroad. It is built and designed to occupy the place of the smaller circular saw mill. The mill is so constructed and arranged that it can be removed from place to place without incurring a very heavy expense. The lower frame is a strong arch casting 7 feet wide by 5 feet long. The lower wheel has full web, is turned all over to secure perfect balance, is bolted to a large flange on the mandrel—no keys to throw the face of wheel out of true with shaft axis. The boxes are ball and socket construction with liberal surfaces, and provided with large oil pots. The column carrying the upper wheel frame is box-shaped. The mandrel for upper wheel runs in two self-oiling boxes, one of which can be raised or lowered for tilting, and moved in or out of line for cross lining. The upper wheel has cast iron hub and rim connected by 22 steel spokes, staggered in both wheel and rim, is held on the heavy arbor with feather key and collars. The face of wheel is ground, on its own arbor, to the exact diameter in a special machine. The upper saw guide is of the safety pattern, it raises clear when struck by the log or knee, and is balanced. The tension or straining device is perfect and acts quickly, taking care of the saw blade (which is only 34 feet 6 inches long) under all conditions, thus enabling the use of thinner blades than in the ordinary band mill. The distance between upper and lower saw guides is 36 inches, falling down space 30 inches, so that even large sized logs can be worked up on this mill without difficulty. The single cutting mill has a live roll in the bed, driven from the lower mandrel. The driving pulley on mandrel is 32-inch diameter by 12-inch face, turning 450 to 500 revolutions; speed of saw depends on kind of lumber to be cut.

BACK GEARED CRANK SHAPER.

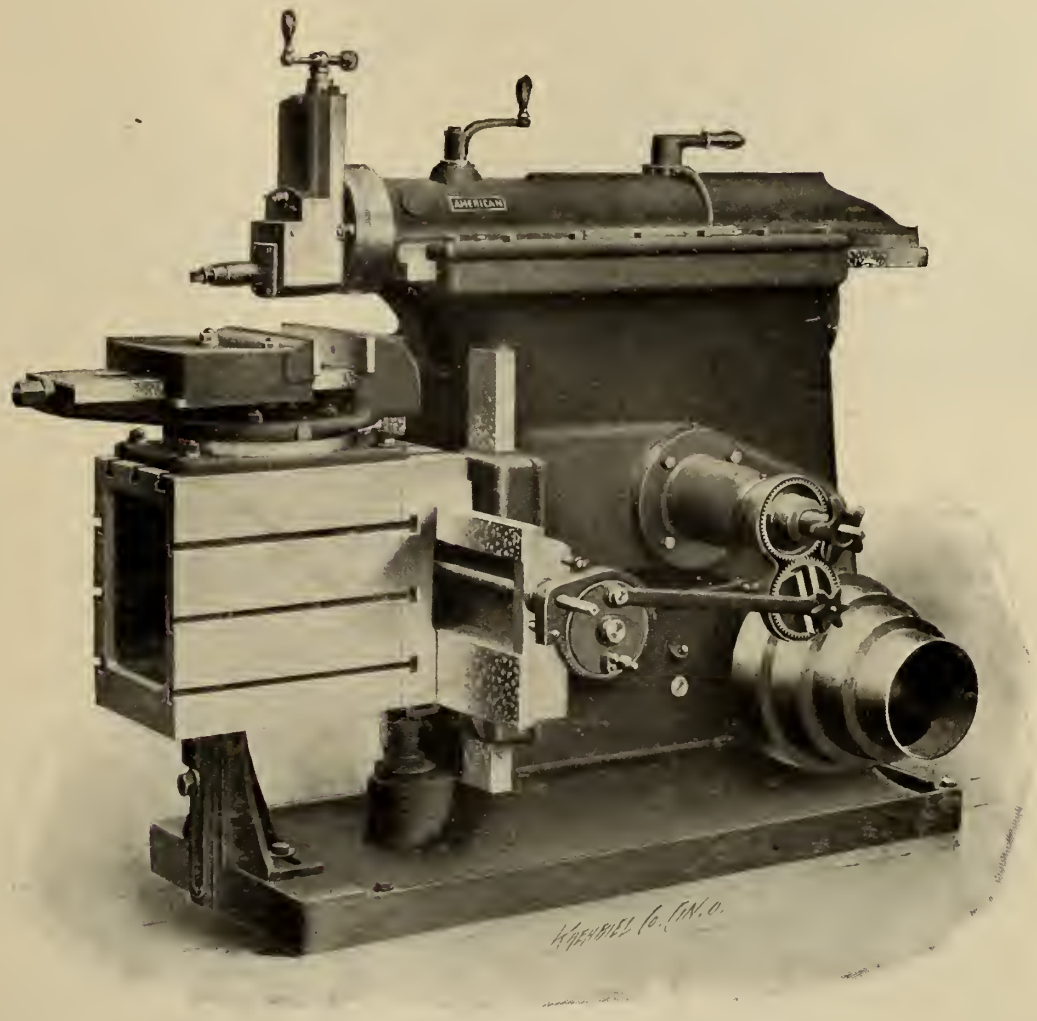
MODERN methods in shop practice and the extensive use of the new high speed tool steels have greatly increased the demands and duties now imposed upon shapers. The shaper, heretofore regarded as essentially a tool-room machine, has been made a manufacturing machine. To meet these changed conditions and new demands the American Tool Works have developed and built an entirely new line of extra heavy and powerful shapers.

The column is unusually deep and wide, tapering slightly towards the top, giving the machine a neat, graceful and substantial appearance. It is strongly braced internally, braces being so disposed as to meet the heaviest strain. The column is further reinforced outside on the line of strain by a wide, deep rib cast integral with the wall, projects both front and rear at the top providing an exceptionally long bearing for the ram. Base is of large proportions, strongly ribbed, of extension type with pad at end to receive table support, when same is furnished. Is of pan construction to hold oil drippings, thus protecting the floor. Stroke of ram is positive and has eight rates of speed ranging from 15 feet to 181½ feet. The length of stroke may be changed at will without stopping the machine. The device for positioning the stroke is located near the head and may be operated while the machine is running. A pointer on the ram traveling along an index shows the length of stroke as set. Rocker arm is extra heavy, thoroughly braced and pivoted near the base line, giving the ram an almost uniform rate of speed its entire stroke and providing an exceedingly quick return. The machine is readily changed from single to back

geared through a convenient lever and has the remarkable back gear ratio of 1 to 29.4, giving it extraordinary power for taking heavy cuts. Head swivels to 50 degrees and has improved locking device. Slide is fitted with taper gib for taking up the wear. Has down feed of unusual length, feed screw having an adjustable graduated collar reading to .001 in. Has large tool post for using holders with inserted cutters and has tool steel tool post screw and steel serrated back plate. Table is of box form with T-slots on the top and sides, cut from the solid with ample allowance of metal around them. Is thoroughly braced internally, insuring great rigidity. Is fitted to apron by an improved method insuring accuracy and great stiffness, and is readily detachable. Apron is accurately fitted to cross rail and is provided with taper gib for taking up the wear. Has three T-slots on face for clamping work when table is removed. Crossrail is a box form very heavy and strongly ribbed. Is of exceptional length, giving the table a long horizontal range of travel. Has extra wide bearings for apron scraped to surface plate. Is secured to column ways by clamps and bolts of improved design which prevent crossrail from dropping away when the binder bolts are loosed. A telescopic elevating screw of large diameter is provided with ball bearings for making easy the elevation of rail. This enables the machine to be set on a concrete or other floor without requiring a hole through same to accommodate the travel of the screw. Elevating gears are of steel planed from the solid.

The ram is very heavy and designed for uniform rigidity throughout the entire length of stroke; is thoroughly braced by internal ribs and has long wide bearings with taper gib for taking up the wear. Cross-feed is variable and automatic with a range of .0114 to .250 with easy arrangement for any desired feed. The mechanism is substantial and simple, giving an exceptionally wide range. It readily adjusts itself to any elevation of the rail. Reverse of feeds is accomplished by simple manipulation of the knob shown, without stopping the machine. Rocker arm is made double section at the top, and this, with large opening through the column, permits a shaft 3½-in. diameter to be passed under the ram for key seating. Larger shafts may be key-seated by setting over table to allow the shaft to pass outside of column, using the head set on an angle.

All gears are cut from the solid with special cutters. Bevel gears are planed and are coarse pitch and wide face. Pinions in driving train are cut from bar steel. Easy access is provided to all working parts with convenient and effectual means for constant lubrication. All bearings are extra wide and scraped to surface plate. All running bearings are bushed to afford replenishing in case of wear. Bearing for driving pulley is massive and cast integral with column; is exceptionally long, extending well into the centre of cone, eliminating the necessity of an out-bored bearing for cone shaft. This bearing is bronze bushed. All shafts are of high carbon crucible steel, accurately ground. Points of danger are amply covered to prevent injury to the operator.



American Back Geared Crank Shaper.

You remember what Gen. Sherman said about war. His remark would have been equally applicable to the mind so tortured by business cares that it cannot forget them even on Sunday.

TURRET LATHE FOR SPECIAL WORK.

FOR finishing the interior and ends of small gasoline engine cylinders, Pratt & Whitney have placed on the market a very efficient and satisfactory turret lathe. The special head provided for this purpose is shown in Fig. 1. The other illustration shows the machine without the usual rod feeding and holding device. It is, instead, fitted with a special chuck for rigidly holding the cylinder and with turret and cross slide tools for boring the inside of the cylinder and for turning and facing a collar at one end. The work is gripped by means of two swinging clamps on the chuck. Each clamp operates against two fixed points, and also has two boring pins and a swinging member. The work, consequently, is supported on eight separate points while it is being machined. This avoids the necessity of clamping so tightly as to distort the casting, and also insures that the bore and the cylinder will be true when the work is removed from the chuck.

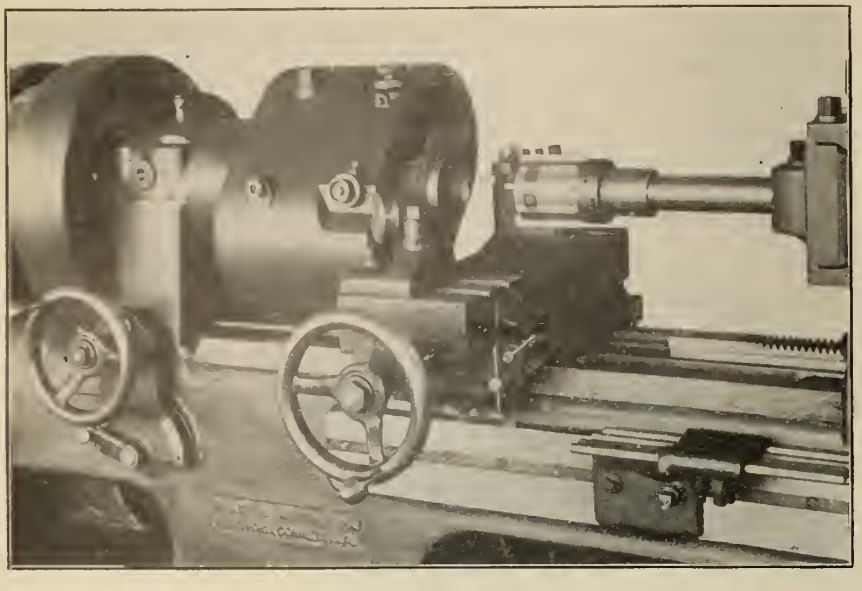


Fig 1 Special Head of Pratt & Whitney Turret Lathe.

The turret tools are for boring cylinders and consist of rigid boring bars with high speed cutting tools. An arm holding the cutter for turning the collar heretofore referred to, is fitted on the shank of one of the bars, and is clearly shown in the illustration. No detailed explanation of this feature is necessary.

The reamer for finishing the hole is allowed to float on its shank and is of the expansion type. The illustrations of the cross slide tools also are self-explanatory. It may be noted, however, that as both the turret slide and the cross slide have independent power feeds, both the boring and the cross slide tools have simultaneous action and effect considerable economy in time. The cylinder shown in the illustration has a diameter of 4 inches, and is 7 inches deep.

This lathe is particularly applicable to automobile manufacture. A large number are in use on this work and are giving excellent satisfaction. Where there is insufficient work to keep the machine constantly at work on castings, it is advisable to have it equipped with a rod feed and collet mechanism. This would permit rod work to be handled as well as the castings.

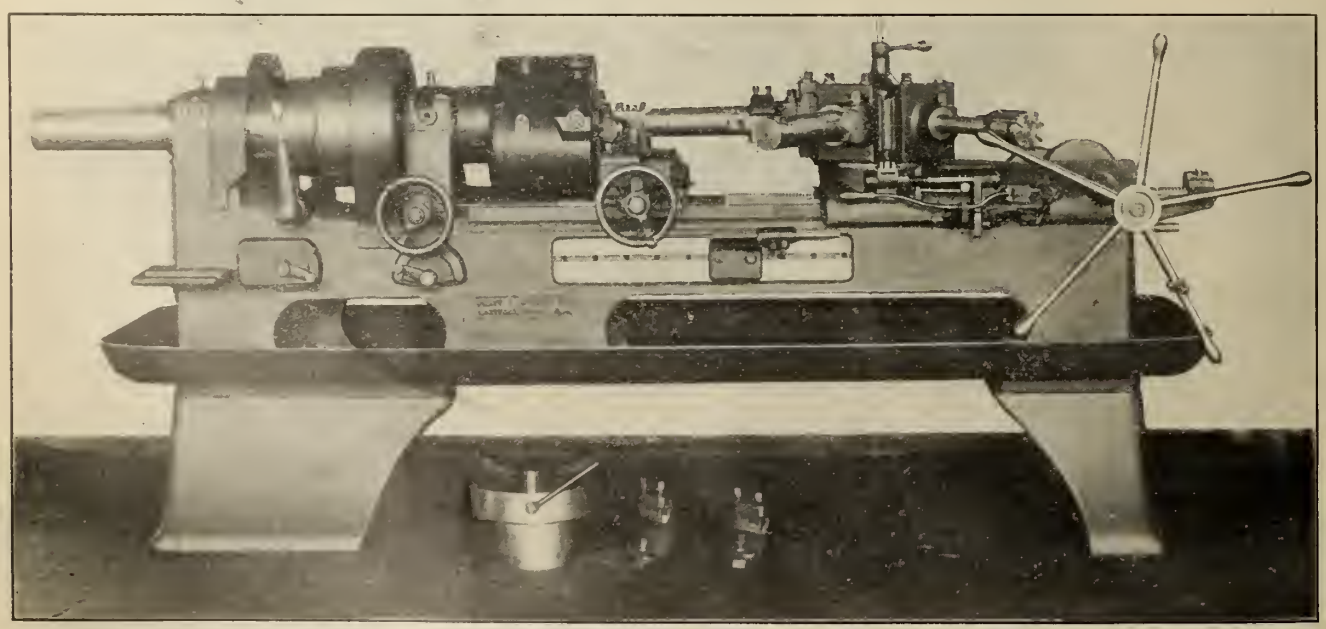


Fig 2 3 x 36 in. Pratt & Whitney Turret Lathe.

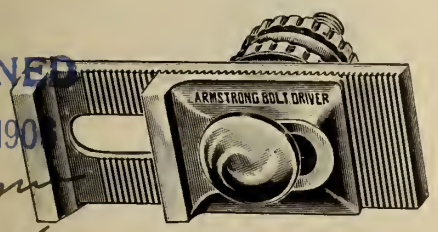
MECHANICAL SPARKER FOR GAS ENGINES.

A NEW type of spark generators for gas engines, which does away with the customary commutator and the magnetic vibrator, is described in a catalogue recently issued. The mechanical vibrator contains two platinum contacts. Even though the engine may be turning very slowly, no contact is made until the spring is released. All of these parts are very light, which allows for a quick release of the spring, and as the duration of contact can last no longer than the time taken for the release of the spring, and as the time

is always constant, no matter how low the intervals between each release, a quick "make and break" is always accomplished, making a spark of a constant size for all speeds of the engine.

ARMSTRONG BOLT DRIVER.

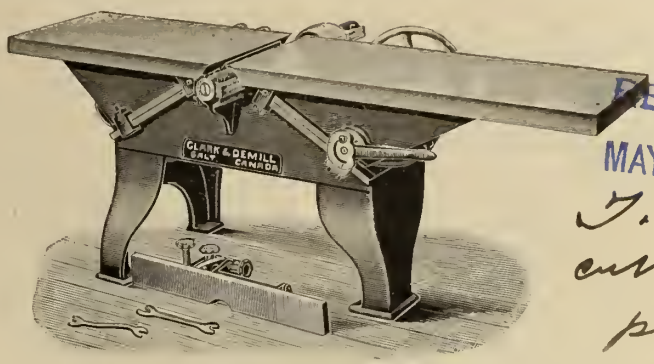
IN the two accompanying illustrations are shown a bolt driver recently placed on the market by Armstrong Bros. Tool Co., Chicago. Its particular use, and a field in which it will meet with a ready reception, is for turning and threading bolts in a lathe. There should be a good demand for a device of this sort. The views given show clearly the details of this holder as well as its method of application. As will be seen it is adaptable to square, flat or hexagon stock. By means of the extension washer between the driver and the face plate of the lathe the position of the driver can be adapted to centres of varying lengths. The driver is made in three sizes varying in capacity from two to four inches.



Armstrong Bolt Driver.

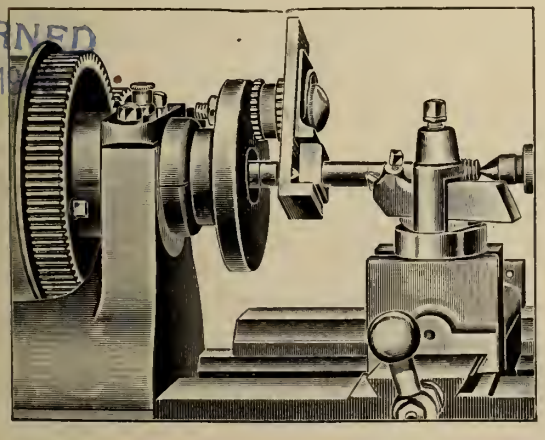
IMPROVED WOODWORKING MACHINES.

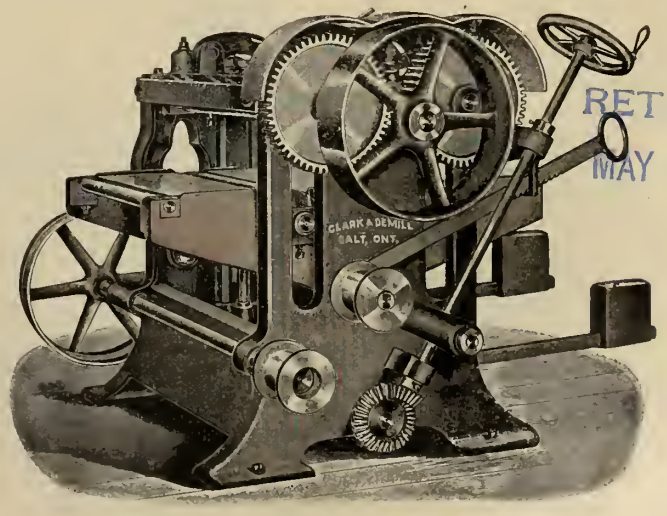
SOME of the recently designed woodworking machines, the product of Clark-Demill Co., Hespeler, are illustrated herewith. The improved pony planer is a strongly built machine for general use in box and furniture factories, planing mills, etc. The cylinder has large and long bearings, 1¾ in. x 6½ in.; is forged from a solid bar of high-grade steel; is driven from one side by patent anti-pneumatic double flange pulley, 5 in. x 5½ in. The hood in front of cylinder forms a chip breaker and pressure shoe and moves in a circle with the cylinder. It is so arranged that in taking ¼ in. cuts the hood will lift about 3-16 in. before the lumber reaches it, thus preventing a great deal of the strain on the hood, and at the same time holding the lumber firmly so as to prevent any roughness in planing. The steel scraper is attached to the delivering roll, which prevents it from gumming and marking the lumber. The shaving guards prevent shavings from getting beneath the smooth roll and imprinting the work — an important point in the purchase of a smoothing planer. Top rolls are solid, 3 in. in diameter and are strongly geared. Bottom rolls are 5 in. in diameter, giving a very strong feed. The table is 3 feet 3 in. long, and the screws for raising and lowering are square-threaded, passing through brass nuts, and move ⅛ in. to each turn of the handle. The handle for raising and lowering the same is convenient to the operator, as is also the indicator. A lock is provided so the table will not move when set to the thickness required. The countershaft when ordered is separate from machine, and can be placed underneath, above or on the floor, as may be desired.



Perfection Buzz Planer and Jointer.

The other machine shown is a Perfection buzz planer and jointer, of which the frame and cylinder bearings are cast in one solid piece. It is extra heavy and strongly built, and has three points of bearing on the foundation so that it cannot be twisted by unevenness of foundation or floor. The tables are 7 ft. 3 in. long, and move on continuous inclined ways. An adjustable bevelled gauge is provided, secured to the rear or short table so as not to interfere with the working table. The eccentric under front or working table allows the table to tilt perfectly parallel from 0 to 1½ in. for hollow or glue jointed. This allows the back or short table to remain always set true to receive the work. In this machine there are no links or pin joints under the tables to get out of adjustment or wear slack. The machine having a three point bearing, it is impossible to strain or twist it by bolting down, or by floor settling, etc., and no projecting flange for the operator to tread upon. By means of the large hand wheel at right, the working table can be moved either to


Bolt Driver in Operation.



Clark-Demill Pony Planer.

or from the cutter-head without requiring the operator to change his position in the least.

STERLING POWER HACK SAWS.

ONE of the noteworthy features of the Sterling power hack saw, manufactured by the Diamond Saw & Stamping Works, Buffalo, N.Y., is the interposition of a train of reducing gears between the driving pulley and the crank shaft. By this means the pulley is allowed to run at a greater speed than in a direct-driven machine, so that a narrower belt can be used and still have ample driving power. To avoid the complications and difficulties frequently experienced with a clutch the machine is driven by the older method of tight and loose pulleys. The arrangement is such that after the work has been completely cut through the next return stroke of the saw automatically throws the belt from the tight to the loose pulley. The device has the advantage of greatly reducing the liability of breaking saw blades. The saw is fed in the usual way by its own weight, with the provision of means for adjusting which tends to avoid the buckling or breaking of the saw blade and adapts the saw to cutting of different materials between the extremes of soft steel and tool steel. The machine is made with all parts interchangeable, so that new parts may be readily substituted for ones that have been broken or worn out, making the machine easy to keep in repair.

The design of the machine as a whole is commendable for the effective distribution of metal to provide the greatest strength for the least weight. To obviate any likelihood of the shafts getting out of alignment or working loose the bearings of the driving shaft and crank shaft are cast on the bed.

NEW PIPE BENDING MACHINES.

THE accompanying illustration shows a machine lately perfected by Pedrick & Smith, Philadelphia, for bending pipe cold. Piping of steel, iron, brass, copper or other material can be bent cold up to and including 2 in. in diameter. The machine is also adaptable by means of special formers for bending light angles, flats and tee bars.

RETURNED
FEB 7 1906
To Canada
Cut Book 47
Page 41
W. S. E.

Improved Pipe Bender

The gearing is compound with a ratio of 25 to 1, thus giving the machine a powerful leverage. A boy can bend 2 in. pipe with little effort. The machine

RETURNED
FEB 7 1906
To Canada
Cut Book 47
Page 41

Sterling Hack Saw.

is operated by a hand wheel consisting of four handles which, by means of the compound gearing, engages the face plate, to which are attached the bending quadrants. The pipe is held in the quadrant at the one end by means of a steel plate, while the resistance stud on the movable arm engages the other end. The various curvatures are obtained by adjusting the arm, which has a swing of three-quarters of a circle, supplemented by the movement of the resistance stud in the "T" slot of arm. The machine is mounted on a telescopic stand which can be raised or lowered to any suitable height; when the base is fastened the upper part swivels. A universal arm or section for the stand is furnished, so that if so desired the face plate can be placed in a horizontal position at any height from the floor. Quadrants are furnished with the machine for 1 in. pipe with a radius of 6 in., for 1¼ in. pipe with a radius of 9 in., for 1½ in. with a radius of 12 in., and for 2 in. pipe with a radius of 14 in. While these four quadrants are furnished with the machine, we find that the smaller sizes of pipe can be readily bent, and satisfactorily, in the larger size quadrants. In fact workmen will not take the time to change the quadrants unless they desire a smaller radius than the larger quadrant will give them.

SELF CONTROI

If you are tempted to be angry, pause a moment and still the rising activities. Deal in the same way with the tendency to be annoyed, resentful or depressed. Remember that if you spare yourself these useless expenditures of force, you husband and increase your energy.—Dresser.

Practical Questions and Answers

Horse-Power from Torque and Speed

Ques.—In the testing of an electric motor by brake test, you have the speed of the motor and the pressure of the brake arm upon the scales, besides electrical measurements of the input power. How can you find the horse-power output of the motor under these conditions of speed and input power?

Ans.—The length of the brake arm in feet multiplied by the pressure of the arm on the scales in pounds will give the torque in foot-pounds produced by the motor. Then if the speed of the motor be reckoned in revolutions per minute a convenient formula for finding the horse-power is:

$$H.P. = \frac{T \times N}{6300}, \text{ where}$$

H.P. = horse power,
T = torque in foot pounds; and
N = revolutions per minute.

Advantages of Compound Air Compressors.

Ques.—What are the advantages of compressing air in two, three or four stages in an air compressor?

Ans.—As air is compressed in a cylinder its temperature rapidly rises. If during the stroke no heat is removed from the air in the cylinder the air is said to be compressed adiabatically; or if during the compression the heat as it is generated is removed by some means and the air in the cylinder thus kept at the same temperature throughout the stroke, the compression is said to be isothermal. If the air is compressed adiabatically it enters the receiver at a much higher temperature than the surrounding atmosphere, and as it cools down to the atmospheric temperature, the pressure takes a corresponding drop; on the other hand, if compressed isothermally the air upon entering the receiver is at atmospheric temperature and consequently there is no change in either temperature or pressure. Thus it is evident that to obtain a certain final pressure in the receiver in the adiabatic compression it would be necessary to compress to a somewhat higher pressure than that of the receiver, so that when the air cooled down the pressure would not drop below that required in the receiver. Raising the air to this higher pressure would mean an extra amount of work done.

There are two methods adopted to bring the compression as near isothermal as possible; one of these is by water-jacketing the cylinder, and the other is to compress the air in two, three or four stages, cooling the air to atmospheric temperature, or as near to it as possible, in intercoolers between each compression. Although water-jacketing is a very common practice, it is not as effective a method of cooling as one might wish because air is a poor conductor of heat and during the stroke there is not time for the water to absorb much heat from the air. Experiments conducted on single cylinder compressors, with water-jacket, and with compound compressors, also water-jacketed, have shown over one hundred per cent. greater saving in lost power for the compound compressors than for the single-cylinder compressor.

These foregoing facts might be expressed mathematically somewhat as follows:

The equation for the isothermal compression curve is $p\,v$ = constant, or $p^1 = p^0 \left(\frac{v^0}{v^1}\right)$, while the equation for the adiabatic compression curve is $p\,v$ = constant $^{1.405}$, or $p^1 = p^0 \left(\frac{v^0}{v^1}\right)^{1.405}$

The amount of work necessary for compression is least for the isothermal and greatest for the adiabatic. The adiabatic curve can be made to approach the isothermal curve by decreasing the exponent 1.405. With a single-cylinder compressor with an efficient water-jacket this exponent can be reduced to 1.25, while with the compound compressor with water-jacketed cylinders and efficient intercooling devices the exponent can be reduced to 1.15.

Size of Steam Supply Pipe.

Ques.—It is required to supply a steam engine with steam from a boiler. The steam consumption of the engine is known. From that how would you determine the size of steam pipe required?

Ans.—A formula commonly used for this purpose is as follows:

$$d = 0.5374 \sqrt[5]{\frac{Q^2 L}{H}}, \text{ where}$$

d = diameter in ins. of steam pipe required.
Q = quantity of steam in cubic feet per min.
L = length of steam pipe in feet; and
H = height in feet of a column of steam, of the pressure of the steam at the entrance, which would produce a pressure equal to the difference of pressures at the two ends of pipe.

The value of H can be found from the formula:

$$H = \frac{144\,(p^1 - p'')}{w}, \text{ where}$$

p^1 = pressure in pounds per sq. in. at boiler end of pipe;
p'' = pressure in pounds per sq. in. at engine end of pipe; and
W = weight per cubic feet of steam at pressure p^1.

Thus we get formula:

$$d = 0.5374 \sqrt[5]{\frac{Q^2 L}{\frac{144(p^1 - p'')}{w}}}, \text{ or}$$

$$d = 0.5374 \sqrt[5]{\frac{Q^2 L w}{144(p^1 - p'')}}$$

In this formula Q is known or can be found from known quantities, i.e., steam consumption of engine, L is known, P is known (boiler pressure), and w can be found in any table of steam properties. The two unknown quantities are d and $(p^1 - p'')$, and from the formula a relation between them is obtained. The pressure required at the engine can be decided upon, and will practically have to be decided upon before Q can be known accurately. Hence the value of d is determined.

As a check on this result the velocity of the steam through the pipe of diameter d might be found from formula:

$$V = \frac{12Q}{2\pi d}, \text{ where}$$

V = velocity in feet per min.

This velocity for stationary engines should not exceed 100 feet per minute.

Suction Pipe for Boiler Feed Pump.

Ques.—How can the size of a suction pipe necessary for a boiler feed pump be determined?

Ans.—If the speed of the piston is known or can be determined, and if the length of the suction pipe will not have to be more than 24 feet, the following emperical formula may be used, which is based on the assumption that the velocity of the water through the suction pipe must not exceed 200 feet per minute, for fear of excessive frictional loss, and that there are not more than two elbows in the pipe: Size of pipe is given by 7-10 diameter of pump cylinder multiplied by 1-100 of piston speed in feet per minute.

For moderate wear the piston speed should not exceed 100 feet per minute.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

A. M. McGill has re-opened the foundry at Chatsworth, Ont.

F. B. Moffat, of Enderby, purposes erecting a flour mill at Vancouver.

The Stuart Machinery Co., of Winnipeg, will erect shops at a cost of $10,000.

Edmonton has decided to take over, own and operate its own street car lines.

The Bulwell Coal Co., of Calgary, has started operations near Lethbridge, Alta.

The Peterborough Lock Co. have paid a dividend of 6 per cent. for the past year.

The International Harvester Company will erect a warehouse at Regina this year.

The directors of the Winnipeg General Hospital have decided to erect a nurses' home.

The amount of bounty paid on iron and steel for the past calendar year was $1,900,206.

The Raymond Mill & Elevator Company will build a $25,000 mill at Magrath, Alta.

T. Long & Bro. will erect a large elevator and cold storage warehouse at Collingwood.

Geo. Esterbrook, of Tweed, Ont., expects to erect a large flour mill at Vancouver, B.C.

The Canadian Otis Elevator Works, of Hamilton, will build a $4,000 addition to their works.

Heard & Co's tool works, of St. Thomas, report a very busy season, particularly in rakes.

Tenders are asked for the erection of a brick Methodist Church at Markdale, to be 70 by 72 feet.

A three-storey carriage factory will be erected at Fredericton, N.B. E. A. Morgan is interested.

A joint stock company is being formed at Lansdowne, Ont., to erect a large harness factory there.

The Roberts Heating and Ventilating Co., Minneapolis, will build a $20,000 warehouse at Winnipeg.

The Cockshutt Plow Company purpose building a large warehouse in Arcola, Man., next Spring.

The factory of the Canada Glue Co., Brantford, is about completed and will soon be running full time.

A new smelter is proposed to be established at Cobalt, by the proprietors of the Timmins Mine.

The town of Rainy Lake passed a by-law to raise $35,000 to install a waterworks and sewage system.

Over 100 men are at work on the Canadian Metal Company's works at Frank, Alberta, and smelting is to commence in about a month.

The Calgary Lime & Cement Company are building new lime kilns and otherwise extending their plant.

Building in Haileybury, Temiskaming district, has been going on all Winter. The town is growing rapidly.

J. Trussler, of Owen Sound, is at the head of a cement brick company which will build a factory in Berlin.

The Sandstone Brick Co. have bought ten acres southwest of Peterboro for the new plant it has just ordered.

The Toronto Bolt & Forging Company will erect a 400-foot brick extension to their plant at Swansea.

R. H. Grimstead, of Minneapolis, purposes building a factory in Winnipeg for the manufacture of steel harrows.

Price Bros. & Company are reconstructing their mill at Metabetchouan, Que., which was destroyed by fire.

The Y.M.C.A. will shortly erect a building at the corner of McRoberts and St. Clair avenues, Toronto Junction.

It is rumored that the C.P.R. intends to push the branch line which runs from Mattawa on to Cobalt this Summer.

Joseph Cameron is erecting a shingle mill on some limits he holds near the Port Moody road in Coquitlam, B.C.

J. E. Beliveau will erect a three-storey, forty-room hotel at Brantford, corner of First avenue and 22nd street.

The Peterboro' Board of Education are asking for $30,000 to build a new public school in the south end of the city.

The Dominion Coal Co's output for January, 1906, was 231,606 tons, an increase of 70,000 tons over January, 1905.

3,280 permits for 4,030 buildings, of an aggregate value of nearly $11,000,000, were issued in Winnipeg last year.

The manufacturers' committee of London, Ont., will ask the city council for $1,000 for the purpose of advertising the city.

The Kingston Yacht Club, Kingston, ask tenders for removal of their old club house and the erection of a new one.

Ontario Wind Engine & Pump Co., Toronto, are to build a three-storey and basement brick factory, to cost $8,000.

The Richelieu & Ontario Navigation Company will build three new passenger steamers at a cost of about a million dollars.

The Canada Jute Company and the Dominion Bag Company have amalgamated and will build a large factory in Winnipeg.

Over one thousand prospectors' licenses have already been taken out this year from the Government office at Haileybury.

Dresden ratepayers will vote on a by-law to provide $25,000 to assist A. H. Turner, of Toronto, in building a twine factory there.

The production of carborundum in the United States in 1905 is estimated at 5,596,280 pounds, against 7,061,380 pounds in 1904.

Compton & Montgomery are erecting a new store building at Daysland, Alta. A new hotel, the Argus, is also building a large annex.

Winder Bros., of Berlin, announce their intention of building a three-storey and basement furniture factory, to cost $25,000.

The Farewell Foundry Company, Berlin, will soon have their foundry running. Their output will chiefly be iron pipe and fittings.

The American Locomotive Works, Montreal, are delivering sixteen high-class passenger engines to the Intercolonial Railway.

The Dominion Sewer Pipe Company are running their works to the fullest extent in order to handle their large northwest business.

E. W. Hewson, of Amherst, N.S., will erect a four-storey building for business purposes in Vancouver, costing between $35,000 and $40,000.

Tenders are asked for the erection of a new post office building at Regina. February 23 is the date of time limit for receiving tenders.

Woodstock may have another industry which will manufacture a new patent screen, the rights of which are controlled by local men.

M. Fisher, Sons & Company, purpose erecting a seven-storey warehouse and office building on the lower part of Victoria square, Montreal.

The Canadian Rand Drill Co., Sherbrooke, Que., will build extensive additions to their works, including the erection of a new foundry.

The Sydney Steel Works report an unusually good month for January, the total shipments during the month being upwards of 17,700 tons.

Leon Vanhavrebeve, representing the Belgium Packing Company, is in Lethbridge negotiating for the establishment of a packing house there.

Gatineau Point will grant exemption for 25 years to a company about to build a sash and door factory there. Work will be commenced at once.

Samples of copper ore from Cloud Bay, Ont., have assayed high values. The vein from which the ore was taken is 23 feet wide in places.

It is reported that the Canadian General Electric Company will erect a plant for the manufacture of mining machinery at Rossland, B.C.

The Imperial Wire & Nail Works, of Collingwood, will make extensive additions to their plant, as will also the Collingwood Furniture Co.

The Michigan Central shops, of St.

Thomas, have been very busy of late, but the Pere Marquette shops have been rather slacker than usual.

Tenders will be asked shortly for the erection of a new barracks at Toronto, for the permanent corps. About 400 men will be accommodated.

The International Atcheson Graphite Co's factory at Niagara Falls is now in operation. This factory has ten electric furnaces costing $35,000.

The Kenora Board of Trade will ask the town council to secure surveys and estimates for an electric railway between Kenora and Keewatin.

The winding up of the Robinson & Turner Co., of Toronto Junction, ladder manufacturers, shows no visible assets, and liabilities of over $5,000.

The Canadian Pacific Railway Company will build terminals at Lethbridge, Alta., including a ten-stall roundhouse, freight shed and repair shops.

A by-law to grant a bonus of $10,000 to Brunet & Couson, to establish a shoe factory at Maisoneuve, Que., will be submitted to the ratepayers.

The Canadian Military Institute, Toronto, have purchased property on Simcoe street, and will erect a new club house at a cost of about $15,000.

The McDonald, Dunlop Company, of Calgary, are erecting a three-storey brick warehouse, 130 feet long by 25 feet wide, which will cost $12,000.

The Imperial Steel & Wire Company, Collingwood, are to build a wire fence plant. Their nail mill is working on large orders from wholesale houses.

The Anthony Wire Fence Co. are installing machinery in the factory they have leased at Windsor, and will employ 10 or 15 hands in a short time.

The Amherst Foundry Company, Amherst, N.S., have ordered from the Smart-Turner Machine Company, Hamilton, a single beam traveling crane.

The Intercolonial Railway Co. have delivered their new 80-pound rails from Sussex to St. John, N.B., which will replace the 50-pound rails now in use.

The Norris Safe & Lock Company will build a five-storey block in Vancouver. The company has recently completed a six-storey building in Seattle.

The Brandon Brewing Company, who had their factory burned on Christmas Day, will rebuild on a larger scale than ever. The new building will cost $75,000.

The Midland Construction Company will have two large steel scows constructed, to be used in connection with their new dredge, which is now being built.

The shareholders of the Canadian Pacific Railway Co. will be asked to consider the increasing of the company's capital stock from $110,000,000 to $150,000,000.

The Garr-Scott Threshing Machine Company are negotiating with Regina with a view to erecting a large warehouse there, similar to the one in Winnipeg.

The Grand Trunk Railway Co. have authorized the expenditure of three and a half millions in rolling stock in order to handle the coming season's wheat crop.

The Canadian Pacific Railway Company will build a large storehouse in Montreal, in connection with its freight sheds, for the convenience of the merchants.

The Metal Shingle & Siding Co., Preston, have secured the contract for the metal roofing of the new field mechanics' building at the Guelph Agricultural College.

Canadian railways have already placed orders for 200,000 tons of rails for 1906. These rails will be made in Canada, at Sydney, C.B., and Sault Ste Marie, Ont.

Mr. Frederic Nicholls, president of the Niagara and St. Catharines Railway & Navigation Co., announces that he will put a new boat on the Port Dalhousie line for 1907.

The city of Vancouver issued building permits in January, 1906, representing $177,920. This exceeded December last by $27,000. A busy year in building is expected there.

The shareholders of the Brantford Screw Company will be asked to increase the capital stock in order to put their plant in shape to handle their growing business.

It is announced that the Grand Trunk Railway Company will build a large bonded warehouse this year on the property expropriated for the new Union Station in Toronto.

It is announced that the Grand Trunk will spend a million dollars in London on raising the tracks, constructing subways, and the erection of a new station building.

The Fraser River Lumber Company, of New Westminster, B.C., will build a two-storey saw mill 34 by 84 feet. The place will be equipped with up-to-date machinery throughout.

E. D. Brand, who has disposed of his interest in the Berlin Electrical Company, is at the head of a new company who will shortly begin the manufacture of dry batteries in Berlin.

Brantford may have an electrical supplies factory. An outside company have had a representative there with this in view, and the city council have promised to assist the new industry.

The Monarch Brass Works, of Port Colborne, struck a good flow of natural gas at a depth of 1,000 feet in their gas well. Their whole plant will now be run by gas from their own well.

The Central South African Railway will shortly call for tenders for supplying Douglas fir. Copies of specifications may be had from the Superintendent of Commercial Agencies, Ottawa.

Messrs. Geo. Schlee, D. B. Detwiler and M. B. Shantz will build a button factory in Berlin, employing between 50 and 60 hands. A sandpaper factory is also spoken of for this town.

The Board of Education for Toronto have made large appropriations for the erection of new schools and collegiate institutes, and for the enlargement of many of the present buildings.

The Niagara, St. Catharines & Toronto Railway Co. will apply to parliament for permission to extend its line from Niagara Falls to Brantford, also from Thorold to Niagara-on-the-Lake.

After expending $25,000 the Western Gas & Oil Company has struck gas at Edmonton at a depth of 1,450 feet. The pressure of the flow is 250 pounds, and it produces a clear white light.

The Western Counties Power Company have acquired the plant of the Brantford Electric & Operating Company and will operate in that city. They intend to bring Niagara power to Brantford.

W. H. Banfield & Son, Toronto, are meeting with unqualified success in the placing of their drop hammers and power presses on the Canadian market, having received numerous orders lately.

The bursting of a boiler in the Stanfold block, Montreal, recently partially wrecked that building, but, fortunately, no one was injured, although there were many people in the building at the time.

The Granby smelter, at the Boundary Mines, in the Kootenay district, produced $2,000,000 lbs. of copper last month. The Granby smelter is the largest copper reduction works in Canada.

Montreal capitalists are interested in the peat, gas and coal company recently organized at Portland, Maine. T. P. Gelinas, of Montreal, is president, and J. D. Oligny, of the same city, treasurer.

Assessment Commissioner Forman states that a large oil industry will be erected on Ashbridge's Marsh, Toronto. They will commence with about 25 men and an immediate expenditure of $20,000.

The contract for railroad construction near Manila has recently been given, amounting to $16,000,000, to the J. G. White Co., of New York, of which the Canadian White Co., of Montreal, is a branch.

The Canada Flax & Cordage Co. will establish a twine factory at St. Mary's to cost $60,000 and undertake to employ 50 hands on condition that the town guarantee bonds to the amount of $25,000.

The citizens of Midland, have hopes of that town becoming the lake terminus of the Grand Trunk Pacific railway. The G.T.P. have purchased considerable yard room and water frontage there for this purpose.

After April 1 next the Toronto Street Railway Co. will pay a dividend of six per cent. per annum instead of five per cent. In percentage of earnings, rentals and taxes, the city received during 1905 $405,638.89.

The Maritime stove manufacturers are having trouble in their provincial association on account of one concern in Sackville employing striking employes of another factory, which is contrary to agreement.

The Lyons Electric Company, of Brantford are asking that city for a ten years' franchise for commercial lighting. They offer to supply a current at a flat

rate of 5 cents for a 16-candle-power lamp a week.

Assessment Commissioner Foreman, of Toronto, has been negotiating with representatives of a large firm from the State of Indiana, now employing 400 hands, who wish to locate a branch factory in Canada.

The Granby Company have acquired the Pathfinder Mine, and in the early Spring will pen up and work the property. The Pathfinder Mine is a gold-copper proposition, 12 miles from Grand Forks, N.D.

The Allis-Chalmers Company are putting in a large saw mill plant on the west coast of Vancouver Island, at Mosquito Harbor. The machinery has just arrived from Milwaukee and is up-to-date in every way.

The Ever-Ready Fire Extinguisher Co. have secured control of a new fire fighting appliance which contains a combination of carbonic acid gas and water. They will manufacture these articles at Brandon.

Building operations in Langham, Sask., will be extensive this year. This time last year there was only one shack there, and now every business is carried on there except banking. Several buildings are already started.

The sub-station of the Huronian Power Company, at Copper Cliff, is nearing completion. Power will be transmitted to Copper Cliff in two weeks. About $250,000 has been expended on the power house and equipment.

The Canadian Northern are preparing to commence work in earnest in the Spring on their long-talked-of line to Hudson Bay. A party of surveyors have been working all Fall and Winter on the proposed line.

The Dominion Coal Company have under consideration a scheme to build homes for their 5,000 miners. The plan is to build houses suitable to their ability to purchase, and allow eight years in which to pay for them.

A new smelting furnace has been invented by Mr. Blanchard, of Spokane. It is a double blast furnace, and the chief claims for it are rapidity in smelting and a saving of fuel. Raw coal is used instead of coke.

Immense quantities of steel rails are being shipped to Fort William and stored there awaiting shipment further west. Some of this is for the Seattle & International Railway line, and some for Cowley and Laggan, B.C.

The Wolverine Reed Co., of Detroit, have closed their plant there and are moving to Walkerville, having leased the building formerly occupied by the match company. The reed works will employ from 50 to 60 hands.

The Toronto Railway Company are building a number of cars for Winnipeg, and will also build more new ones for the Toronto service. The company have also been negotiating for about 5,000 tons of steel rails for Toronto.

Wilson B. Bechtel, of Bechtel Bros., brick manufacturers, of Waterloo, has left the firm, and purposes erecting a modern brick-making plant. He will invest between $12,000 and $15,000, and will employ about fifteen hands.

The Dominion Coal Company's earnings for 1905 were $1,573,000, as compared with $1,602,000 for 1904. The decrease is owing to an unremunerative contract at present existing with the Dominion Iron & Steel Company.

Williams & Wilson, of Montreal, state that the demand for carborundum wheels is unprecedented and that more orders have been filled for these wheels during the past few months than were called for of other abrasives for several years.

At the annual meeting of the Ottawa Electric Railway Co., Thomas Ahearn was re-elected president. The gross receipts of the road were $449,000, and the net profits of the year $143,000. A dividend of 10 per cent. was declared.

The stone quarries owned by the Western Fuel Company on Newcastle Island, near Nanaimo, B.C., which have been idle for some time, have been reopened under the management of the Northwestern Construction Company.

A six-storey hotel, to cater to the best trade, will be built in Vancouver by the Marquis de Biddlescope, on the corner of Cordova and Seymour streets. Clark & Stewart, wholesalers, will also build shortly, on the opposite corner.

Since the death of Walter Grose, of Montreal, the Nicholson File Agency, held by that firm, has been discontinued. The Canadian business will now be conducted from Port Hope, with Mr. Chas. S. Archibald as Canadian representative.

R. E. T. Pringle & Co., Limited, have been granted permission to erect a large electrical factory on Delisle street, St. Henri. The new structure is to be a most complete one and will be thoroughly equipped with labor-saving machinery.

The Lock Safety Pin Company, of St. Louis, are negotiating with Smith's Falls with a view to establishing a plant there for the manufacturing of the Lox safety pins, hair pins, hooks and eyes, etc., which at present are all imported.

H. J. McNeill, of Brandon, president of the Great Northern Manufacturing Company, has sold the invention known as the threshing machine belt guide and shifter, with all rights, to S. S. Graham, of Fargo, and J. C. Foster, of Hope, N.D.

The International Railway car barns at Niagara Falls have been destroyed by fire, the loss amounting to $125,000. It is reported that the company may move its division headquarters to Niagara Falls, N.Y. Thirty cars were destroyed with the barns.

The Canadian Copper Company is surveying a right of way from Copper Cliff to Creighton to convey power to the property there. The operation of the entire plant by electricity is proposed, and plans are now being prepared with this end in view.

The Canadian Pacific Railway Company have given an order to the Dominion Car Company for 200 steel coal cars to cost upwards of a million and a half. They were not able to make them at their own shops in Maisonneuve owing to pressure of work.

An American company of capitalists have purchased a tract of iron land at Sheep Rock Lake, near Fort Frances, from W. A. Preston, of Fort Frances. The purchasers will immediately expend $50,000 in exposing the ore and getting some on the market.

The City Council of Hamilton, in opening the tenders for the cement supply, were somewhat surprised at the increase in price asked by the different dealers. The uncertain condition of the coal situation has had a tendency to make the cement men cautious.

The Canada Foundry Company, of Toronto, have made arrangements for the erection of a derrick at Fredericton, N.B., to remove the steel spans from the cars which will arrive in February. These spans are for the superstructure of the Fredericton highway bridge.

Tests made by the Canadian Northern Railway with Edmonton coal show that a train hauling 700 tons of freight from Edmonton to Vermillion burned seven and a half tons of this coal, as compared with eight tons of Crow's Nest coal used under the same conditions.

Allis-Chalmers-Bullock, Limited, of Montreal, have removed their sales office for the Maritime Provinces from Halifax to New Glasgow. This is considered a more central locality for the great steel, iron and coal industries with which a large portion of their business is done.

The Dominion Coal Company have commenced the erection of a new foundry at Glace Bay, N.S. A machinery storage house, 30 x 110, is also being erected, and further work will be carried on in the near future in the construction of a machine shop and the sinking of a well.

Alex. Morison, of Bay City, patentee of a process for manufacturing binder twine from flax cordage, is in Sarnia regarding the erection of a factory there. It is claimed for Mr. Morison's process that it will produce a superior binder twine at much less than the present prices.

Mackenzie & Mann have given a contract to J. P. Mullarkey and M. J. O'Brien to build 100 miles extension to the Great Northern Railway in Quebec. Eighty miles will run from Garneau Junction to Quebec City, and twenty miles from Montfort Junction to St. Jerome.

The Window Glass Machine Company of Canada have entered into agreement with the town of Cayuga, which will be voted on March 2. Representatives of the Imperial Plaster Company, of Toronto, have also been to Cayuga with a view to opening up the plaster deposits there.

One of the largest orders for machine tools ever given at one time by a single company was placed recently by the Allis-Chalmers Co., of Milwaukee, the price for these being $550,000. They include forty-two machine tools of extra heavy pattern, designed especially for the use of high speed steels.

The Manitoba Iron Works purpose erecting a large boiler shop and structural iron working department, and to

facilitate the handling of heavy iron required for this work, have applied to the Winnipeg City Council for the privilege of double tracking their spur across Henry avenue.

H. W. Petrie, of Toronto, has opened a branch at the corner of St. James and Little St. Antoine streets, Montreal, where a good line of machinery will be kept in stock. Mr. A. W. Royan, who formerly represented John Bertram & Sons, Limited, in Montreal, will have charge of the branch.

Vancouver men—Geo. Martin, Wm. Shannon and W. H. Higgins—will erect iron and steel furnaces and mills at Eburne, B.C., where they will treat the magnetic ore deposits by electrical process. Lead and wooden pipe factories are also planned. English capitalists are interested in the scheme.

Despite the troubles amongst the directors of the National Portland Cement Company, at Durham, the stock of that concern is being quoted at higher figures. Meetings of the shareholders are being held at various centres and proxies secured in preparation for the coming annual meeting of the company.

The Robb Engineering Co. have recently received an order from the J. R. Booth Co., Ottawa, for one 20 x 36 inch Robb-Armstrong Corliss engine; two 22 x 36 inch Robb-Armstrong Corliss engines, and three 14 x 24 inch Robb-Armstrong Corliss engines. The above engines are for the paper mills at Ottawa.

The Hamilton Cataract Power, Light & Traction Company have decided to open the radial extension from Burlington to Oakville on May 1. Arrangements were made to double-track the radial from Hamilton to the canal early in the Spring. A dividend of five and a half per cent. was declared for the past year.

The recent inquiry into the congestion of the grain traffic in Western Ontario and at Georgian Bay points will result in an increase in the rolling stock of the Grand Trunk Railway Co. It was announced that the Grand Trunk Railway Co. would put on 5,000 new freight cars to satisfy the demands of the grain traffic.

The Allan Steamship Company will ask the Government to establish a system of telephonic and telegraphic communication on the St. Lawrence route to Montreal. They say that during the bush fire season smoke hangs heavily over the river, which, with the fogs they sometimes have, renders river traffic hazardous.

A valuable deposit of graphite has been found at French Vale, Cape Breton, by Mr. Neil L. Campbell. At a depth of 25 feet a 13-foot seam was discovered, samples of which on analysis were found to contain 75 per cent. of graphite. It is within four miles of the I.C.R. line, and six miles from Bras d'Or Lake.

The Williams Co., shoe manufacturers, have closed their factory in Galt, and will move the machinery to Brampton and merge with another business there. Under an agreement with the town they occupied an $80,000 building bought by the town to encourage the industry. The premises are already applied for by other concerns.

An evidence of the briskness of Canadian trade in the machinery and power and transmission development is shown in the plant of the Dodge Mfg. Co., Toronto, where the machine shop has been running over time for some weeks past, and where to keep up with a growing business additional machine tools are being installed.

A phenomenally rich discovery of copper has been made near Dean Lake Station, on the Soo branch of the C.P.R. The ore is found in a soft slate formation, which renders it easy to take out, and runs 12 per cent. copper, one large sample assaying 22½ per cent. copper. The lead has been traced for three-quarters of a mile.

A million dollar contract was given by the Montreal Street Railway Company for a new power house to be completed this year. The company has also let a contract for 6,000 tons of steel rails to lay 50 miles of track. No Canadian companies making "T" rails, the contract went to the United States Steel Corporation.

A company has been formed in Perth to develop a new industry in mica, known as the "thin splitting" process. In the vicinity of Perth there are still to be immense quantities of refuse or small mica, which is used in this work. A factory has been opened in the old bolt works and employment will be given to about ninety girls.

Among the recent sales by Allis-Chalmers-Bullock, Limited, Montreal, were thirty of the latest improved type coal cutters to the Dominion Coal Co., Glace Bay, C.B.; two compound steam-driven air compressors to the Acadia Coal Co., Stellarton, N.S., and a 425 k.w. alternating current generator for the corporation of Parry Sound.

Further experiments of Dr. Heroult at the Soo have demonstrated that pig iron can be produced by the electric process from red hematite at less than $10 per ton. This is significant in view of the fact that only a few days ago a leading steel manufacturer declared that it cost from $14 to $15 to produce pig iron by the old process.

The Canadian Shipbuilding Company will build for the St. Lawrence & Chicago Navigation Company one of the largest fresh water vessels afloat. It is expected she will be ready to go into commission in the Spring of 1907, and will be in the 10,000 ton class between 450 and 500 feet in length, although as yet the dimensions are not given out.

The Boundary Iron Works, Grand Forks, B.C., has declared its first dividend, which will be five per cent., payable on March 1. The business of this foundry has grown enormously, and it is expected it will do at least a $50,000 business during 1906. The machine shops of the Ketter Valley Line Railway have been removed to this foundry.

The Steger Sand Lime Brick Company, of Vancouver, will put on the market a new brick or building stone made from Britannia tailings. The brick will consist of fine particles of quartz bound together by lime in the proportion of five per cent. It is claimed for it that it will withstand nearly four times as much weight as the ordinary brick.

It is reported that Mackenzie & Mann will build a $5,000,000 smelting industry in the Ashbridge Bay district, Toronto. They hold an option on a valuable tract of iron ore land just outside Hutton, Ont. This company have a great deal of ore property, and the object of this smelter in Toronto is to have an outlet convenient to the Great Lakes.

The new smelter at Copper Cliff, erected for the treatment of cobalt ores from the mines in the Sudbury district of Ontario, has been successfully installed. The smelter has a capacity of 10 tons daily and is being operated as a custom smelter for the treatment of all precious metal bearing ores. The cost of erection was approximately $100,000.

Tenders have been called for the building of one of the most important sections of the Grand Trunk Pacific, from Touchwood Hills to Edmonton. Among those who tendered were Foley Bros. & Larson, J. McArthur, the Canadian White Company, McDonald, McMillan & Co., and Johnson & Sons. This section of the Grand Trunk Pacific is 450 miles in length.

At the coming session of the Ontario Legislature the Minister of Mines will introduce legislation with a view to having all the nickel ore mined in Ontario converted into marketable nickel before leaving Canada. Canada supplies 60 per cent. of the nickel of the world, but at present the ore is converted into the finished product in the States, and sold as American nickel.

The annual steel production of the United States is the largest in the world, amounting to fifteen million tons. Germany comes second with eight million tons, and England third with five millions. The 450 steel works in the States represent an investment of over $442,000,000, and pay $102,000,000 annually in wages. These figures represent the crude production only.

The Montreal Copper Refining Company, the only company refining copper in Canada, offer their stock for sale. Before the formation of this company all Canadian copper ore was shipped to the United States to be refined, and then re-shipped back to Canadian users. Besides supplying the home market to some extent, the Montreal refinery also export their product to Great Britain and Germany.

Frederiek Nicholls, of the Electrical Development Company, has twice absented from the Royal Commission on hydro-electric power, although subpoenas have been served upon him. He feels that in giving information he would be guilty of a breach of faith with the shareholders, and wanted the permission of the president Sir Henry Pellatt, who is abroad, before he would give testimony.

Some iron and steel manufacturers are not inclined to agree with Dr. Heroult, the French expert, who has been

conducting experiments in the reduction of ore by electricity, and who states that pig iron can be produced for $10 a ton. Montreal steel men say Dr. Heroult's basis for calculating cost in this electrical process is an erroneous one, and would not bear the test of practical manufacture.

The aggregate value of the contracts for the two sections of the National Transcontinental Railway for which tenders are asked will be from twelve to fourteen million dollars. The new syndicate, headed by W. J. Poupore, of Montreal, will be a strong rival to Foley Bros. & Larson for this contract. This latter firm have at present the contract of double tracking the C.P.R. from Port Arthur to Winnipeg.

The Allis-Chalmers-Bullock, Limited, Montreal, recently received an order from the Canadian Forty Mile Gold Dredging Co., of Toronto, Canada, for a special gold dredge equipped complete with 5 1-3 cu. ft. buckets. The contract covers the entire machinery equipment complete, ready for operation, including electric light plant, two boilers, 100 H.P. each, engines, pumps, etc. The dredge will be ready for use early in May.

The Lake Superior Corporation will erect two new open hearth blast furnaces at the Soo, which will increase their steel output by one quarter, at a cost of about $250,000. The company have applied to the Government for a rebate of the duty on coal used for making coke, and if this is granted they will also construct at least 50 coke ovens. These improvements, when completed, will require about 500 more men.

The Whelpley Skate Company, of Greenwich, is asking concessions from Fredericton, N.B., with a view to going there to manufacture. The company ask for a free site or nominal rental, exemption from taxation, free water and a loan of $5,000. In return the Whelpley concern will erect a $20,000 plant that will have an annual output of $30,000, and for the first year will employ 25 men. The Whelpley skates are well known in Canada.

The Smart-Turner Machine Co., of Hamilton, are installing their automatic feed pumps and receivers, and their duplex pumps in many localities. Recent orders for these include E. Leonard & Sons, London; the Belgo-Canadian Pulp & Paper Co., Standard Soap Co., Calgary; Hamilton Cataract Power, Light & Traction Co., Hamilton; Wilson Steel Works, Toronto; Geo. Frid & Co.; the London Fence Machine Co., Murray's free stone quarries.

Hon. Henry Cecil, mining engineer and mine owner, says that it is the policy of those who are interested with him in British Columbia copper enterprises to divert the export of copper so that it will go through British, instead of American, channels. To this end they have in view the establishing of a large copper refinery at Montreal. A small copper refinery already exists there, and it might form the nucleus of something greater to be.

The National Malleable Castings Company, of Cleveland, has brought suit against the Smith's Falls Malleable Castings Company for $50,000, for breach of contract. The plaintiffs claim that by agreement they were to be supplied with twenty couplings a day for a year, and that in April last orders were not filled. The defendants claim nonexistence of any agreement, and if any contract had been made by their late president it was not sanctioned by the board of directors.

The Baldwins, British locomotive builders, are seriously considering the advisability of establishing a plant in the Maritime Provinces, in order to compete with the Americans. A factory in Canada would be of great value both as a source of employment and as a benefit to the Empire. It is only by increasing the manufactories here that Canada can help Britain in her unemployed problem, and the Canadians would do well to assist in the establishment of these large enterprises.

The Winnipeg General Power Company started to extend their lines into the city, but were stopped by the city engineer and the chief of police. The company claim that the right to enter Winnipeg is embodied in their charter and will apply to the Government for permission to do so. The city intends to run its own municipal power and has secured water sites for that purpose, and for this reason will shut out the Winnipeg Power Company, which is controlled by Mackenzie & Mann.

The Great Northern Railway is to construct a connecting line between their Similkameen county system and their trunk line. The object of this is to more easily get coal for the Hill railways and steamships. At present most of the coal used by the Hill people is brought from Montana, which, as well as being a long haul, does not give them the high quality of coal that is to be had from the Similkameen mines. The construction of this road will be commenced in about three months.

A number of Minneapolis capitalists have purchased the Shannon lumber interests in British Columbia, which comprise in all 30,000 acres of timber land and a mill site at Port Henry, for a sum exceeding $80,000. The purchasers among whom are W. W. Cargill, John Graham and Mr. Matthews, will erect a large mill on the site and will cut timber for the Canadian Northern on a contract already secured. They have also tendered for a large Grand Trunk Pacific contract, and will export ties and timber to Mexico and the Panama Canal.

Amongst special apparatus at present being completed by the Smart-Turner Machine Co., Limited, Hamilton, are an automatic spike machine for Geo. Barr, Chicago, smoke stacks, Crow's Nest Pass Coal Co.; tilting tumbling barrel, the Canadian Steel Goods Co.; wire crimping machine, the B. Greening Wire Co.; five-ton hand-power traveling crane, E. Leonard & Sons, London; wire fence loom, Frost Wire Fence Co., and a direct connected centrifugal pump and motor for the Hamilton Cataract Light, Heat & Power Co.

It is stated that more aluminum is manufactured in Niagara Falls than in any other place in the world. The aluminum works at that place have been in operation just ten years, and in that period the development of the aluminum industry has resulted in an enormous demand for the metal. In 1904, 8,600,000 pounds of aluminum were made in this country, an increase of 1,100,000 pounds over the preceding year. At the end of the first decade of manufacture in 1893 the total of the American product was only 339,629 pounds.

The Trail Smelter, Trail, B.C., received last year 227,000 tons of ore. From this ore was produced 82,000 ounces of gold, 1,360,000 ounces of silver, 13,280,000 pounds of lead, and 4,520,000 pounds of copper. An electrolytic lead refinery was put in, and the smelter has for some time past been receiving the crude lead ore from the Slocan mines. The result of this has been that they have been enabled to carry on the whole process of lead production, from the crude ore to the finished lead pipe, which is now put on the market direct from the works.

The fourth annual report of the president to the shareholders of the Chicago Pneumatic Tool Co. was issued on Feb. 8, which shows a large extension of business, and profits amounting to 9.15 per cent. available for dividends, of which 4 per cent. was appropriated to pay dividends and the balance, amounting to $315,134.39, carried to surplus account. During the past year the company acquired the business of the Philadelphia Pneumatic Tool Co., Philadelphia, and the Canadian Pneumatic Tool Co., Montreal, which company is now conducting the Canadian business.

Fetherstonhaugh & Co., patent solicitors, Canada Life Building, Montreal, publish the following list of patents recently obtained through their office. E. How, Hillsburg, Ont., draft equalizers, C. H. Bennett, Ottawa, water coolers; J. Murphy, Ottawa, means for combating anchor ice and frazil; G. Wettlaufer, Stratford, Ont., brick making machines; Byron W. Guthrie, Montreal, vent valves; Carl R. Salmen, Montreal, fire lighting apparatus; Joseph Ward, Montreal, display envelopes; Thomas E. Ainley, Uxbridge, Mass., fleece carrier; the Anti-Mal-de-Mer Belt Co., Montreal, abnominal belts.

Below will be found a list of Canadian patents recently secured through the agency of Messrs. Marion & Marion, patent attorneys, Montreal, Canada, and Washington, D.C. Information relating to any of these will be supplied free of charge by applying to the above-named firm. Stuart R. Fry, Killarney, Manitoba, railway rail; Hilary Querlarney, Man., railway rail; Hilary Quertier, Dunedin, New Zealand, apparatus for clearing the rails of tramways and the like; Simon Belanger, St. Jean Baptiste, Man., seed drill attachment; George Laporte, Campbell, Neb., U.S.A., acetylene generator; Archibald Turner, Leicester, Eng., speed indicators and recorders; Allan Gillender, Longueuil, Que., stove pipes; Edwin Sunderland, jr., St. John, N.B., disinfecting apparatus; Archibald McDonald, Montreal, automatic smoke preventing apparatus;

Ernest Renaud, Montreal, Que., semaphore operating means; John W. Tierney, London, Eng., pneumatic hammers and similar tools; Philippe Vidal, Ste. Cunegonde, Que., smoke consumer; Wesley Albt. Beelin, Portage la Prairie, Man. vehicle bearing; Elie Perron, Chicoutimi Basin, Quebec, sewing machine; Martineau & Prevost, Montreal, Que., water trap.

The Western Fuel Company are opening up the coal mines at Departure Bay, B.C., that were abandoned thirty years ago on account of having supposedly been worked out. Recent investigations, however, have revealed the fact that this district is rich in coal deposits. At present extensive operations are being carried on there again, and the latest improved facilities for coal mining are being employed.

Peterborough is expectant of great development upon the completion of the Trent Canal. Mr. D. Hughes-Charles, president of the Board of Trade, states that Mr. Robert Stuart, of the American Cereal Company, informed him that upon the completion of the canal his company would erect a 5,000-barrel flour mill. A mill of this daily capacity would be the largest in Canada, and would mean a great deal for Peterborough.

The Niagara-Welland Power Co., of which Harry Symons, of Toronto, is president, have filed their plans at the York County registry office, showing the route of their transmission wires through the County of York to the terminus in the City of Toronto. These transmission wires will parallel the Grand Trunk from the town line of Peel township into the Village of Weston; thence to Toronto Junction and along St. Clair avenue into the City of Toronto.

Canada's trade with Jamaica during 1905 has been very satisfactory. The Canada-Jamaica steamship line of carriers have materially assisted in the development of this business and are about to put on a line of vessels especially constructed for this trade. The Elder-Dempster Company also purpose putting on an up-to-date fleet of steamers to run from Halifax and St. John in the Winter, and Montreal in the Summer, to cater to this carrying trade. This innovation will be very welcome and will create still closer relations between the colonies.

As a result of the efforts of the recently inaugurated Board of Trade of Watford, a proposition has been received from the Lloyd Automatic Wire Weaving Co., of Toronto. The company asks for a loan of $15,000, a free site, and exemption from municipal taxes, the loan to be repaid in twenty annual installments, without interest. The company agrees to employ twenty-five hands at the end of the first year, thirty the second and thirty-five the third year. They will also erect a factory 50 x 150. The by-law will be submitted to the ratepayers in February.

The Tariff Commission held a session at Londonderry, N. S., recently, Messrs. Fielding and Paterson attending. Thos. J. Drummond, president of the Londonderry Iron Co., asked for an increased duty and continuance of the bounty on pig iron. He claimed that the duty and bounty combined amounted to only $2.72 in 1906, and after June, 1907, three would be no bounty. He asked that a bounty of $2.00 a ton be paid for a further period of five years so as to give protection equivalent to $2.50 per ton, regardless of British preference. The chief competition was from Great Britain. The Montreal Pipe Co. asked an additional duty on iron pipe to enable them to compete with Scottish pipe makers. B. F. Pearson, M.P.P., asked for a large bounty to furnaces using native ore.

W. K. Lowden, of St. Lambert, Que., has recently ordered one 14 x 24 inch Robb-Armstrong Corliss engine, and the Moffatt Stove Co., Toronto Junction, Ont., have ordered one 13 x 24 inch Robb-Armstrong Corliss engine. The Town of Westmount have ordered for their new electric lighting plant, two 13 and 25 x 14 inch Robb-Armstrong, cross compound, vertical engines, and one 8 and 14 x 8 inch Robb-Armstrong cross compound vertical engine. These engines are arranged for direct connection to electric generators and are of the English vertical high speed type.

Vancouver lumber mills report extremely busy times ahead. In fact, some of them are already so busy they are refusing offered trade. Most of the mills have run all Winter without a shutdown, and have been as busy as in the Summer. With the expected demand for railway construction timber, it is hardly possible for the mills to cope with the trade which will offer. Demand from the Northwest has not begun yet, and none of the mills are at present stocked up. Most of them assert that they have not a foot of the ordinary one-inch dressed and matched seasoned lumber, as flooring, siding and "V" joint, in stock. The addition of two large mills at New Westminster to the cutting force of the coast mills will not take care of the increase in trade.

Sir Thomas Shaughnessy, in making the announcement that Quebec would be the terminus for new ocean-going boats which the C.P.R. will put on, stated that Canada has scarcely a port suitable to accommodate these vessels. Montreal is being fitted up with the requisites of a large steamship terminus, but the St. Lawrence channel would have to have a depth of not less than 30 feet and a width of not less than 300 feet, with 500 feet at the bend in order to make it safely navigable for the two large ships that will be put on. This deepening and widening scheme has been considered by the Government, but it would take about seven years to complete the work, and in the meantime Quebec will be the terminus. Halifax was suggested, but the long rail haul made it impossible.

The Town of Port Arthur has entered into an agreement with Hedges & Burleigh, two Boston capitalists, the result of which will probably be the erection of a large steel tube works this year. As already mentioned in Hardware and Metal, the town will purchase one hundred acres of land for a site at Bare Point, and take $100,000 of the company's bonds at par. For their part, Hedges & Burleigh agree to erect a plant costing three-quarters of a million dollars, and commence with two hundred and fifty men. Work will be commenced within three months from the ratification of the agreement by the ratepayers.

J. S. Larke, Dominion Commercial Agent in Australia, reports that Australian conditions generally are improved, and that 30,000,000 bushels of wheat will be exported. The United States manufacturers are reducing prices to meet the preferential tariff in New Zealand. On nails the reduction is from 12 to 20 cents per hundred pounds, in order to prevent Canadian nails coming on the market. The Australian Parliament has risen without considering Canada's offer of reciprocity, or doing anything to reduce the handicap that was placed on Canadian trade by the order adding the cost of inland freights to the value of goods, for customs purposes.

Brantford may secure a new industry in the shape of a brick manufacturing company. Two Americans, J. L. Richardson and L. W. Smith are promoting the scheme, and are said to be backed by a well capitalized company. Their article is known as the "sand lime brick," and is made under the Schwartz American patent. It is a cheap brick, and at the same time a good one, and is being used largely on the other side. Options are held on three different properties, and if the company decides to locate there they will put in a plant valued at $37,000. About fifteen men will be employed.

The Canadian Pacific Railway Co. are considering the advisability of substituting electricity for steam as a motive power, and are making inquiries as to cost, with a view to making some experimental tests. If they decide to try the use of electric motors in the running of their trains, the line between Montreal and Quebec will be the first branch equipped, and the tests will be made during the next six months. Should electricity prove successful, the system of electrification will be gradually extended to other branches. Shawinigan Falls will furnish the energy for the first tests, and in the event of their adopting electricity, Niagara Falls will no doubt be drawn on for some of the Ontario lines.

A very strong case in favor of Government subventions to assist in establishing a steel shipbuildiug industry was presented to the Tariff Commission at Halifax by a strong deputation, which urged the importance of this enterprise not merely in the interests of the Maritime Provinces but from a national standpoint. The growing commerce of Canada demands the establishment of a Canadian merchant marine, and this prospectively great factor in our national development cannot be established without Government assistance, and that assistance must be adequate to insure the successful initiation and prosecution of the industry. The request is for a bounty of six dollars a ton, which with the natural facilities and materials at hand should be sufficient to induce capitalists to take up the project.

New Methods of Iron Production.

Mr. Sontum, commercial agent for Canada in Sweden and Norway, reports the discovery of two very important inventions in connection with the iron and steel industry, which are at present attracting considerable attention. The inventors are two Swedish engineers, Messrs. Grondill and Kjellin, who have found a new method for producing iron from the ore. By Mr. Grondil's system the ore is crushed to fine dust and the iron is drawn out by the aid of strong magnets. It is then moulded into the form of bricks. Mr. Kjellin uses electricity for the same purpose. The patentee has closed contracts with French, German and Italian firms for the employment of Mr. Kjellin's method in the production of from two to three million tons of iron and steel per year. Similar agreements for the production of iron and steel under the Grondil method have been made with other firms, notably the Krupp works at Essen, Germany.

* * *

More Power for Ottawa.

Now that the dispute between the different parties interested in the Chaudiere Falls has been settled there is every reason to expect that further utilization of this magnificent water power will be made, and that more power will be available for individual manufacturers at the capital.

* * *

Engineers' Club of Toronto.

At the February meetings of the Engineers' Club of Toronto the following papers were read and discussed: "The Microscopic Structure of Iron and Steel," illustrated by lantern slides, by Principal John Galbraith; "The Railway Franchise," by Robt. McKay, and "Suburban Railways," by C. H. Wright.

* * *

Attractive Souvenirs.

W. T. Glover & Co., Manchester, have sent two interesting souvenirs, one in the shape of a pipe cleaner and the other a daily calendar. The former is handsome in appearance and an addition to any bachelors den. The calendar contains a large sheet for each day, giving interesting and valuable technical information.

* * *

Sylvester Manufacturing Co. Expanding.

Heretofore the Sylvester Mfg. Co., at Lindsay, Ont., were known particularly as being large manufacturers of agricultural implements of all kinds, in which they catered not only to Canadian western trade, but to the European and South African as well. Recently, however, they have undertaken the manufacture on a somewhat extensive scale of gasoline engines of a range from 1 1-2 to 35 H.P., and in which they are meeting with no small success. This firm now employ from 150 to 200 hands and are running their entire equipment of modern machinery at its fullest capacity. Railway sidings with both the Grand Trunk and Canadian Pacific Railway give the company ample railroad facilities.

* * *

New Boiler Shop.

The G.T.R. shops at Stratford are to be further enlarged by the addition of a new boiler shop and new plate shop, at which time the plant will have accomodation for 1,500 men. The dimensions of the boiler shop will be 125 x 220 feet, and the plate shop about 125 x 50 feet. The present boiler shop will be used for a large erecting shop, affording capacity for 12 new engines.

* * *

Frost & Wood to Rebuild.

The main part of the Frost & Wood Company's plant at Smith's Falls was destroyed by fire on Friday, Feb. 9, and the big machine shop with its very costly machinery, the carpenter shop with its entire contents, the paint shop and the plow shop are a mass of ruins. Their large blacksmith shop was badly damaged, but not ruined. In a short time it can be repaired and in working order again.

The fire is supposed to have started in the vicinity of the dry kilns, and notwithstanding the fact that two nightwatchmen were on duty it got considerable headway before it was discovered. The fire was a hard one to fight on account of the size and arrangement of the buildings, and burned fiercely from 3 a. m. till 7 a.m., when it was gotten under control. The loss, while extremely heavy, was well covered by insurance. The large molding shop together with a pattern building, which adjoined it, were unharmed and this leaves the company in an excellent position to go right on and supply the demand for their machinery. Their big warehouse containing the entire season's output was untouched by the flames, and, while the company is hampered for the time being, they are very far from being "out of business" or incapable of supplying machines to fill their orders.

* * *

Foundry Foremen Association.

The second foundry association to be established in Canada has been organized in Montreal, when David Reid, of the Canadian Westinghouse Co., Hamilton, president of the Hamilton branch, went to Montreal for that purpose. The new officers of the association are: J. B. Rountree, the Locomotive Machine Co., president; Essery, Warden, King & Co., vice-president, and J. F. Gaffney, the Allis-Chalmers-Bullock Co., Limited, secretary and treasurer.

* * *

Stationary Engineers.

A communication has been received from the chairman of the central committee of the Stationary Engineers of Ontario enclosing literature on the subject of the proposed legislation in the interests of that body, for which they are at present petitioning. Space will not permit publication of this, but it is earnestly hoped that their efforts will meet with success and that more stringent legislation be brought into effect along the line of raising the status of the stationary engineer and making it compulsory for anyone in charge of a boiler of 50-h.-p. or over to pass an examination giving him the necessary qualifications.

* * *

Bertram Works Completed.

The present additions to the works of John Bertram & Sons Co., Dundas, have been completed as far as building operations are concerned, the new foundry building being ready for occupation. The equipment for this building is nearly all installed and the power house for distributing the electric power in nearing completion. In this power house will be installed transformers for receiving the power from the Cataract Power Co., the total capacity being 800 H.P., which makes allowance for an extra set, to insure continuity of running in case of accident to those in operation. In addition a complete compressor plant is under way and a 175 k.w. motor generator set for direct current used on foundry crane and variable speed machinery in the machine shops. In addition, room has been provided for a 1,000 gallon underwriter fire pump. The entire additions, with the exception of some installations, are completed and are modern in every respect.

* * *

Canada's First Cement Elevator.

The cement elevator and steel tower built by the Brackman-Ker Milling Co. at Strathcona, Alta., is practically completed. The tower is of steel 6½ feet square and 112 feet high. The elevator is 82 feet to rim and 88 feet to peak and has a capacity of 100,000 bushels. It is 40 feet in diameter outside measure and 39 feet inside, as the walls are six inches thick. About 560 barrels of cement, 1,120 barrels of sand and 1,680 barrels of gravel were used in the construction. Three-quarter-inch iron rods wind spirally around the centre of the wall for the first 40 feet, ½-inch iron rods in the same way for the next 30 feet and then 7-16-inch iron rods from 70 feet to the top. These spiral iron rods are secured to upright half-inch straight iron rods, 12 inches apart in the centre of the wall from base to summit. The latest improved rope-driven machinery is installed in a subterranean passage between the mill and elevator and is capable of discharging 2,000 bushels per hour into the mill. The design of the structure and accessories is that of Elsi Heidenrich, Chicago. The work was commenced September 15 and cost about $18,000.

* * *

Talk on Turbine Propulsion.

At the last meeting of the Engineering Society School of Practical Science, R. Warren, Science '04, gave an interesting lecture on the subject of the propulsion of steamships by means of the steam turbine, in which special reference was made to the design of propellers necessary for high speeds.

Companies Incorporated

The Canadian Key Registry Co., Winnipeg, have been incorporated with a capital of $1,000, to manufacture key rings, etc. The incorporators include F. J. C. Cox, R. A. Taunton and S. H. Matheson, Winnipeg, Man.

The Anderson Stone Quarry Co., of Amherstburg, has been reorganized with a capital stock of $1,000,000, and will begin operations in about two months. $50.000 has been spent in machinery and about 100 men will be employed.

The Croesus Mining Co. has been incorporated with a share capital of $500.000, for the purpose of carrying on a mining and development business. The provisional directors are Shirley Ogilvie, D. L. McGibbon and Travers Lewis; head office to be at Ottawa.

The Dominion Stove & Heater Works have been incorporated with a capital stock of half a million dollars, headquarters in Montreal. The provisional directors are L. E. Kimpton, H. L. Mitchell, R. I. Henicker, W. C. Strachan and W. G. Mitchell, all of Montreal.

The Western Canada Coal Mining Company has been incorporated with a capital stock of $50,000, for the purpose of carrying on a coal business. The provisional directors are J. W. Cockburn, J. A. Christie, W. A. Black, J. G. Dagg and S. H. Dagg, with head office at Winnipeg.

The Silver Leaf Mining Company has been incorporated with a capital stock of five million dollars, for the purpose of carrying on mining, milling and reduction operations. The provisional directors are C. A. Foster, J. H. Spencer and Mary A. Hodgson, with head offices at Toronto.

The Maybank Bronze Metal Co. has been incorporated with a share capital of eighty thousand dollars, with head office at Morrisburg. They will manufacture and deal in brass, bronze, babbit, gun and bell metal. The provisional directors are W. M. Maybank, H. H. Bradfield and C. A. Myers.

The Reinforced Concrete Company has been incorporated with a share capital of $200,000, for the purpose of carrying on a general quarrying and cement business, with head office at Montreal. The provisional directors are D. Loynachan, I. J. Donoghue, J. T. Bethune, A. W. Powell and J. L. Geoffette.

The Northern Ontario Copper Co. has been incorporated with a share capital of $500,000, for the purpose of carrying on a general mining and milling business. The provisional directors are J. A. Montague, O. B. Jury, Uriah McFadden, W. E. Gimby and A. C. Boyce. Head office to be at the Soo.

London Fence, Limited, Portage La Prairie, have been incorporated with a capital of $250,000, to manufacture wire, iron or wire fencing and gates, etc. The incorporators include J. S. Willmott, Portage La Prairie, Man.; H. G. Gray and A. E. Blashill, London, Ont., and A. E. Hinds, Winnipeg, Man.

The Ontario Sewer Pipe Co. has been incorporated with a share capital of $300,000, with head office at Toronto. They will manufacture sewer pipe, paving and building blocks. The provisional directors are J. J. Zimmerman, Andrew Dods, J. A. Macintosh, E. G. Morris and M. B. Peacock, all of Toronto.

Canadian Dredge & Construction Co. has been incorporated with a share capital of $150,000, for the purpose of building and operating dredges, derricks, tugs, lighters, etc. The head office will be at Midland, and the provisional directors are James Playfair, D. S. Pratt, Peter Potvin, D. L. White and W. J. Sheppard.

The Pratt & Whitney Company of Canada have been incorporated with a share capital of $100,000, for the purpose of manufacturing and dealing in machinery and tools. The head office will be in Dundas, and the provisional directors. R. C. McKinney, L. B. Morgan, C. L. Cornell, Henry Bertram and Alex. Bertram.

Messrs. A. Prudhomme & Fils, Montreal, have been incorporated with a capital of $145,000, to manufacture electric motors, dynamos, etc., and to acquire the business now carried on by A. Prudhomme & Fils, and Canadian Hardware Co. The charter members include A. Prudhomme, H. Godin and S. Beaudin, Montreal.

The Allward & McCormick Glass Company have been incorporated with a capital stock of $100,000 for the purpose of manufacturing and dealing in glass throughout Manitoba. The provisional directors are J. R. Allward, A. McCormick, G. F. Stephens, M. F. Christie, and L. C. Stephens, with headquarters in Winnipeg.

The Anthony Wire Fence Company of Canada, with head office at Windsor, has been incorporated with a share capital of $100,000 for the purpose of manufacturing and selling wire fences and machinery for making same. The provisional directors are D. P. Anthony, T. C. Harris, J. C. Hitchshu, J. W. Nixon and C. B. Anthony.

The Brantford Roofing Company have been incorporated with a share capital of $100,000 for the purpose of manufacturing and dealing in roofing paper and materials. The provisional directors of the company are Daniel Henry, C. L. Millhouse, W. D. Shultz, G. S. Matthews, G. C. Shultz, A. H. Elliott and Joseph Cobbledick. Head office to be at Brantford.

The Smith's Falls Foundry & Malleable Company have been incorporated with a share capital of $100,000, for the purpose of manufacturing stoves, ranges, furnaces, gasoline engines and malleable iron goods. The head office will be at Smith's Falls and the provisional directors are Adam Foster, W. A. Gray, John McEwan, Alexander Stephens, Matthew Ryan, A. G. Farrell and D. F. Wood.

The Capital Scale, Brass & Iron Foundry Company, with head office at Ottawa, has been incorporated with a share capital of $40,000 for the purpose of taking over the stock and good will of Gorman, Miller & Dittman, and continuing the manufacture of scales, brass work and weighing machines. The provisional directors are R. B. Gorman, F. Miller, A. E. Dittman, L. J. Kehoe and E. P. McGrath.

CONTENTS

Modern Canadian Manufacturing Plants. 87
Article XIII. The John McDougall Caledonian Iron Works Co., Ltd.

Coal Mining in Southwestern Alberta. 90
By Oliver Hall, M.Sc.

Turbine Plant, Waterloo, Ont. 91

Steam Engine Test. 92

Personal Mention. 93

Editorial. 94
Advertising Towns and Cities.
Factors Towards Success.
Central Power Stations at Mines.
Instal the Latest Machinery.
Tendency in Engineering Practice.
Model Employees' Clubs.

Modern Tendency in Boiler Practice. 96
By H. W. Weller, A.M.I.C.E., M.A.I.E.E.

Valuing Coals by Test and Analysis.. 97
By J. A. DeCew, B.A.Sc.

Recent Engine and Boiler Patents... 98

Steel Smoke Stacks for Mills. 100
By F. C. D. Wilkes, B.Sc.

Practical Mechanics. 101
By W. H. Raeburn.

Construction and Improvement. 103

Our Water Power. 104

About Catalogues. 105

At the Noon Hour. 106

Tricks of the Trade. 107

Power and Transmission. 108
Improvements in Robb-Armstrong Engine.
A Large Steam Turbine Generator.
The Green Air Heater.
Usefulness of Graphite.
Electric Hoisting Machinery.
Mechanical Draft.

Engineering News. 113

Machinery Development. 114
Pony Band Saw.
Back Geared Crank Shaper.
Turner Lathe for Special Work.
Mechanical Sparker.
Armstrong Bolt Driver.
Improved Wood-Working Machines.
Sterling Power Hack Saws.
New Pipe Bending Machine.

Practical Questions and Answers. . . . 119

Industrial Progress. 120

Companies Incorporated 127

MACHINERY BUYERS' DIRECTORY.

Readers of CANADIAN MACHINERY are invited to use this directory as a ready reference when seeking to buy any machinery or machinists' supplies. In it will be found a list of goods made by leading Canadian firms and by the principal firms in other countries who are devoting especial attention to the Canadian market. It is the intention of the publishers of this paper to issue a desk index for machinery buyers, and all advertisers are invited to send in full list of lines manufactured.

Acids.
Canada Chemical Mfg. Co., Ltd., Toronto

Abrasive Materials.
Canada Machinery Agency, Montreal.
The Canadiau Fairbanks Co., Montreal.
H. W. Petrie, Toronto.
Rice Lewis & Son, Toronto.
Williams & Wilsou, Montreal.

Air Brakes.
Canada Foundry Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Air Receivers.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Jenckes Machine Co., Sherbrooke, Que.

Arbor Presses.
Niles-Bement-Pond Co., New York.

Augers.
Chicago Pneumatic Tool Co., Chicago.
Rice Lewis & Son, Toronto.

Axle Cutter.
Butterfield & Co., Rock Island, Que
A. B. Jardine & Co., Hespeler, Ont.

Axle Setter and Straightener
A. B. Jardine & Co., Hespeler, Ont.

Babbit Metal.
Rice Lewis & Son, Toronto.

Barrels, Tumbling.
The Globe Machine and Stamping Co., Cleveland, Ohio.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Bars, Boring.
Niles-Bement-Pond Co., New York.
H. B. Underwood & Co., Philadelphia.

Batteries, Dry.
Berlin Electrical Mfg. Co., Berlin, Ont

Batteries, Flashlight.
Berlin Electrical Mfg. Co., Berlin, Ont.

Batteries, Novelty.
Berlin Electrical Mfg. Co., Berlin, Ont.

Batteries, Storage.
Rice Lewis & Son, Toronto.
Chicago Pneumatic Tool Co , Chicago.

Bell Ringers.
Chicago Pneumatic Tool Co., Chicago.

Belting, Chain
The Dodge Mfg. Co., Toronto.
Link-Belt Eng. Co., Philadelphia
Waterous Engine Works Co., Brantford.

Belting, Cotton.
Dominion Belting Co., Hamilton.
Rice Lewis & Son, Toronto.

Belting, Leather.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
The Dodge Mfg. Co., Toronto.
Rice Lewis & Son, Toronto.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.
Williams & Wilson, Montreal.

Belting, Rubber.
Dodge Mfg. Co., Toronto

Belting Supplies.
The Dodge Mfg. Co., Toronto.
H. W. Petrie, Toronto.
Rice Lewis & Son, Toronto.
Sadler & Haworth, Montreal.

Bending Machinery.
Chicago Pneumatic Tool Co., Chicago.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Benders, Tire.
Boynton & Plummer, Worcester, Mass.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., London, Ont.

Blast Furnace Brick.
Hamilton Facing Mill Co., Hamilton.

Blowers.
Hamilton Facing Mill Co., Hamilton.
Niles-Beuent-Pond Co., New York:
H. W. Petrie, Toronto.
Sheldon & Sheldon, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Blue Printing.
The Electric Blue Priut Co., Montreal.

Boilers.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
John McDougall Calenonian Iron Works, Montreal.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Boiler Plates
R. Sullivan David, Montrea

Boiler Compounds.
Canada Chemical Mfg. Co., London, Ont.
Economical Mfg. & Supply Co., Toronto.
Hamilton Facing Mill Co., Hamilton.

Bolt Cutters.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., London, Ont.
National Machinery Co., Tiffin, Ohio.

Bolt and Nut Machinery.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., London, Ont
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Books, Mechanical.
Technical Pub. Co., Manchester.
The MacLean Pub. Co., Ltd., Toronto.

Boring and Drilling Machines.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
A. B. Jardine & Co., Hespeler, Ont.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.

Boring Machine, Upright.
American Tool Works Co., Cincinnati.
John Bertrau & Sons Co., Dundas, Ont.
London Machine Tool Co., London.

Boring Machines, Wood.
Chicago Pneumatic Tool Co., Chicago.
London Mach. Tool Co., London, Ont.

Boring and Turning Mills.
American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Box Puller.
A. B. Jardine & Co., Hespeler, Ont.

Brushes, Foundry and Core.
Hamilton Facing Mill Co., Hamilton.

Bulldozers.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.
National Machinery Co., Tiffin, Ohio.

Cabinets, Tool.
Armstrong Bros. Tool Co., Chicago.
Rice Lewis & Son, Toronto.
Niles-Bement-Pond Co., New York.

Calipers.
Brown & Sharpe, Providence, R.I.
Rice Lewis & Son, Toronto.
L. S. Starrett & Co., Athol, Mass.
Williams & Wilson, Montreal.

Castings, Grey Iron.
Dodge Mfg. Co., Toronto.
Dominion Rock Drill Co., Napanee, Ont.
F. L. Hare, Oshawa, Ont.
Jenckes Machine Co., Sherbrooke, Ont.
Ottawa Steel Castings Co., Ottawa.
Smart-Turner Machine Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.

Castings, Brass.
Chadwick Bros., Hamilton.
Dominion Rock Drill Co., Napanee, Ont.
F. L. Hare, Oshawa, Ont.
Jenckes Machine Co., Sherbrooke, Que.
Ottawa Steel Castings Co., Ottawa.

Castings, Steel
Ottawa Steel Castings Co., Ottawa.

Cement Machinery.
Allis-Chalmers-Bullock Co., Montreal.
St. Lawrence Supply Co., Montreal.

Centering Machines.
John Bertram & Sons Co., Dundas, Ont.
London Machine Tool Co., London.
Pratt & Whitney Co., Hartford, Conn.

Centres, Milling Machine.
The Stevens Co., Galt, Ont.

Centres, Planer.
American Tool Works Co., Cincinnati.
The Stevens Co , Galt, Ont.

Centres, Shaper.
The Stevens Co., Galt, Ont

Centrifugal Pumps.
D'Olier Engineering Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Charcoal.
Hamilton Facing Mill Co., Hamilton.

Chemicals
Canada Chemical Co., London.
Economical Mfg & Supply Co., Toronto.

Chucks, Ring Grinding.
A. B. Jardine & Co., Hespeler, Ont.
Chicago Pneumatic Tool Co., Chicago.
McLean & Sophus, Montreal.

Chucks, Drill and Lathe.
American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Ker & Goodwin, Brantford.
Krug & Crosby Hamilton.
A. B. Jardine & Co., Hespeler, Ont.
London Machine Tool Co., London.
McLean & Sophus, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Rice Lewis & Son, Toronto.
Standard Tool Co., Cleveland.
W. T. Standish, Toronto.

Chucks, Planer.
American Tool Works Co., Cincinnati.
McLean & Sophus, Montreal.

Chucking Machines.
American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Circuit Breakers.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.

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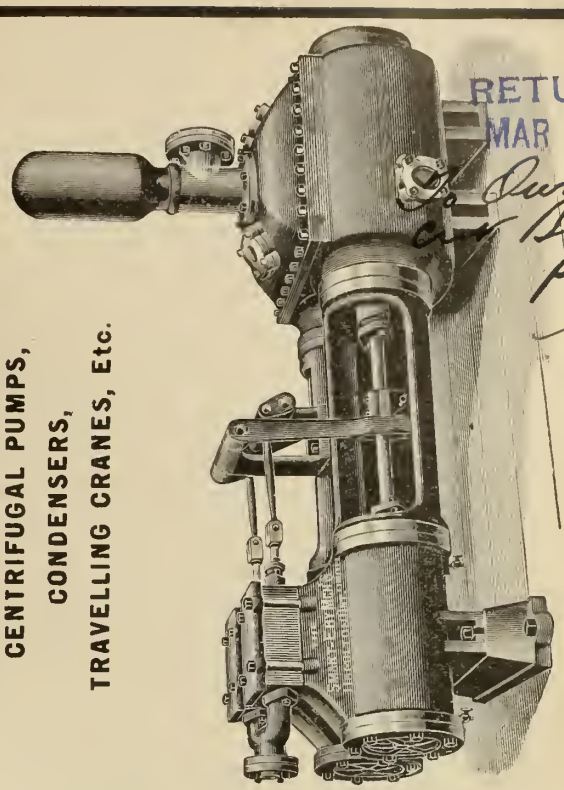

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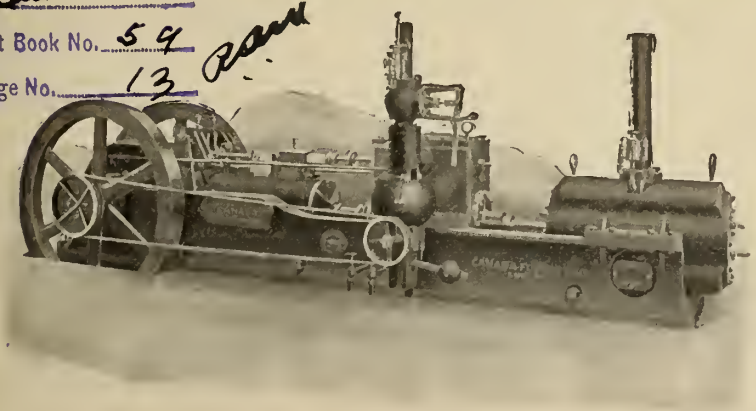

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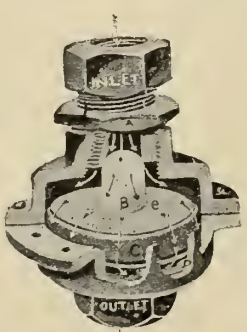

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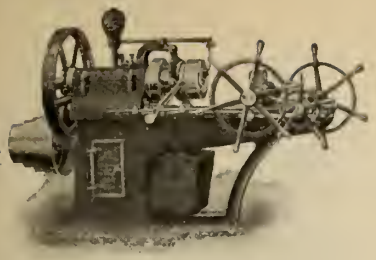

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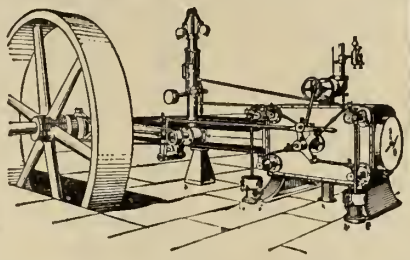

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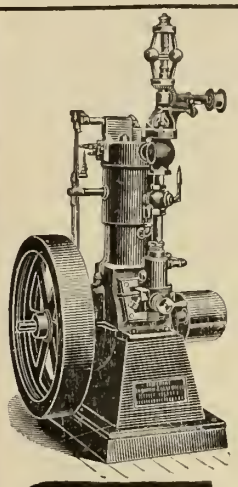

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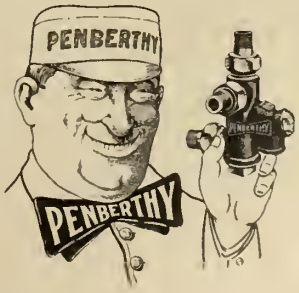

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ALPHABETICAL INDEX.

A

Abbott, Wm. ... 69
Allis-Chalmers-Bullock Co. ... Outside back cover
American Tool Works Co ... 8
Armstrong Bros. Tool Co ... 76

B

Barnes, B. F., Co. ... 7
Banfield, W. H., & Sons ... 67
Becker-Brainard Milling Machine Co. ... 9
Berlin Electrical Mfg. Co ... 59
Bertram, John & Sons ... 9
Bickford Drill & Tool Co. ... 6
Bliss, E. W., Co. ... 7
Boynton & Plummer ... 67
Brandeis, Charles ... 63
Brown & Sharpe Mfg. Co ... 75
Budden, Hanbury A. ... 63
Butterfield & Co ... 70

C

Canada Foundry Co. ... 59
Canada Machinery Agency ... 8
Canada Pneumatic Tool Co ... 76
Canadian Press Clipping Bureau ... 63
Canada Chemical Mfg. Co ... 14
Canadian Fairbanks Co. ... 15, 16
Canadian Rand Drill Co. ... 78
Canadian Westinghouse Co. ... 1
Canadian White Co ... 77
Carr, John ... 61
Carter Publishing Co ... 67
Chadwick Bros ... 69
Chapman Ball-Bearing Co. ... 3
Cincinnati Shaper Co. ... 7
Clark-Demill Co. ... 13
Cleveland Automatic Mach. Co. ... 7

D

David, R. Sullivan ... 69
DeCew, J. A ... 67
Diamond Saw and Stamping Works ... 74
Dodge Mfg. Co ... 2
D'Olier Engineering Co. ... 78
Dominion Belting Co. ... 65
Dominion Rock Drill Co. ... 65
Dominion Sewer Pipe Co. inside back cover

E

Economical Mfg. and Supply Co ... 14
Electric Blue Print Co ... 63
Engineering Specialties Co ... 61
Engineering Times ... 74
Expanded Metal and Fireproofing Co. 65

F

Fetherstonhaugh & Co. ... 63
Fetherstonhaugh & Blackmore ... 63
Fielding, John S. ... 63

G

Geometric Tool Co. ... 73
Globe Machine & Stamping Co. ... 74
Goldie & McCulloch Co. ... 1
Greening, B., Wire Co. ... 68

H

Hamilton Co. ... 59
Hamilton Facing Mills Co ... 65
Hamilton Pattern Works ... 61

I

Int. Siegwartbeam Co. ... 67

J

Jardine, A. B., & Co. ... 74
Jenckes Machine Co ... 68
Jessop, Wm., & Sons ... 69

K

Ker & Goodwin ... 71
Krug & Crosby ... 74

L

Legg Bros. Eng. Co. ... 6
Leonard, E., & Sons ... 65
Lewis, Rice & Son ... 75
Link-Belt Eng. Co ... 3
London Machine Tool Co. ... 5

M

McDougall, John, Caledonian Iron Wks 10
McLachlan Gasoline Engine Co. ... 65
McLean & Sophus ... 72
Marion & Marion ... 63
Merrell Mfg. Co. ... 3
Morrow, John, Machine Screw Co. ... 73
Morton, B. K., & Co ... 69

N

National Machinery Co. ... 65
New Process Twist Drill Co. ... 71
Nicholson File Co. ... 77
Nugent, Wm. W., & Co. ... 61

O

Otis-Fensom Elevator Co. inside back cover
Ottawa Steel Castings Co. ... 69

P

Packard Electric Co. ... 79
Parke, Roderick J. ... 63
Penberthy Injector Co. ... 65
Petrie, H. W. ... 11
Pilkington, Peter, Limited ... 67
Pratt & Whitney Co ... inside front cover
Pringle, T., & Son ... 63

R

Ridout & Maybee ... 63
Rubbra, Alfred ... 61

S

Sadler & Haworth ... 64
Sells Commercial ... 70
Sheldon & Sheldon ... 12
Smart-Turner Machine Co. ... 59
Standard Bolt and Screw Co ... 73
Standard Tool Co ... 72
Standish, W. T. ... 5
Starrett, L. S., Co. ... 71
Stevens Co. of Galt ... 68
St. Lawrence Supply Co ... 70
Sturtevant, B. F., Co. ... 12
Spon & Chamberlain ... 74
Sylvester Mfg. Co. ... 14

T

Taylor & McKenzie ... 71
Technical Books ... 80
Technical Pub. Co. ... 79
Toronto and Hamilton Electric Co ... 78
Toronto Plate Glass Importing Co. ... 61

U

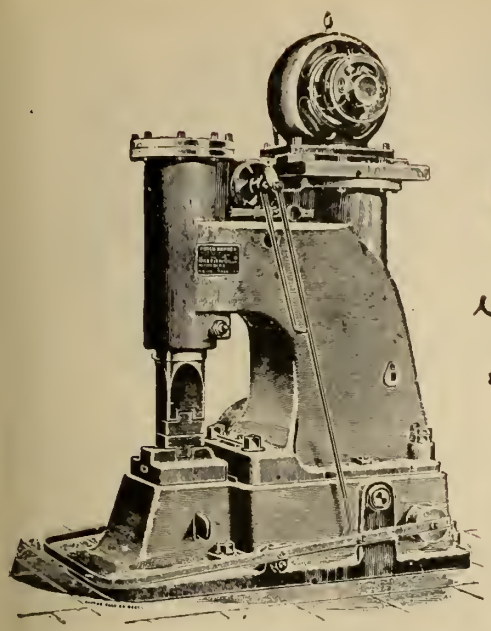
Underwood, H. B., & Co. ... 7
Union Drawn Steel Co ... 68
United Electric Co. ... Inside back cover

V

Volta Electric Repair Works ... 78

W

Waterous Engine Works Co. ... 10
Wayland Williams & Dadson ... 8
West Haven Mfg. Co. ... 73
Wells Pattern & Model Works ... 61
Williams & Wilson ... 4
Wilmarth & Morman ... 5



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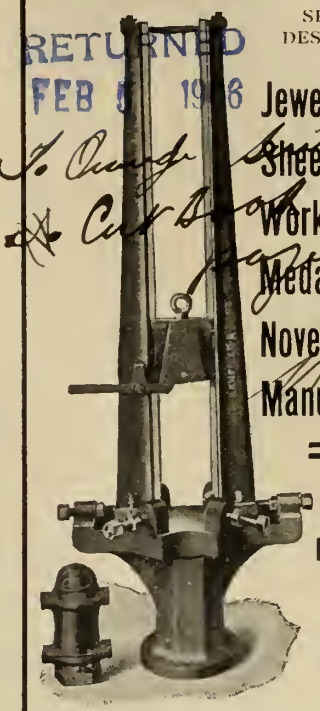

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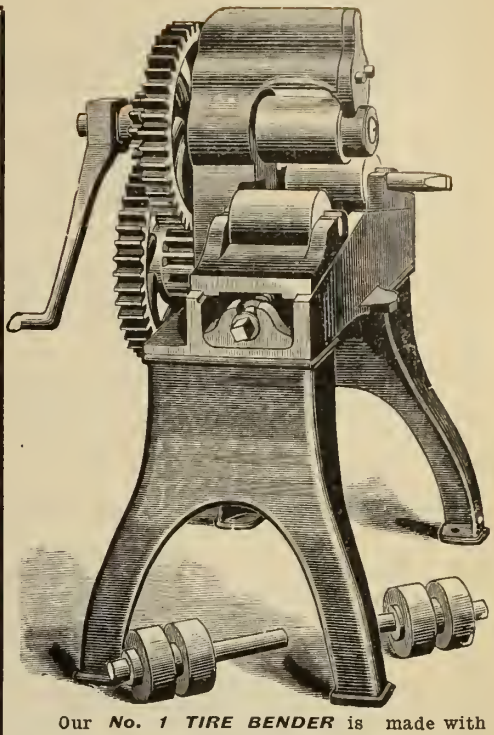

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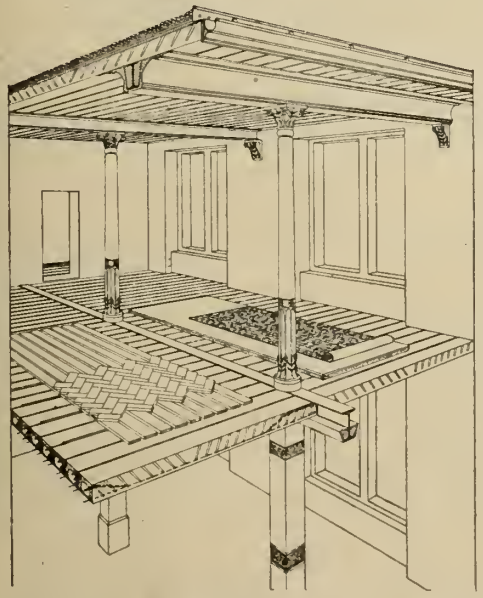

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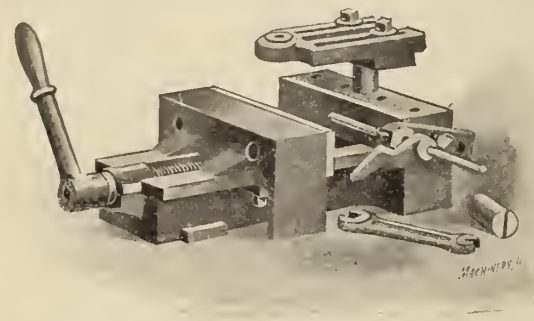

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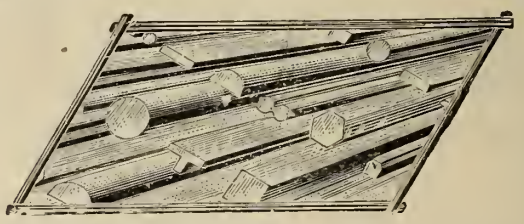

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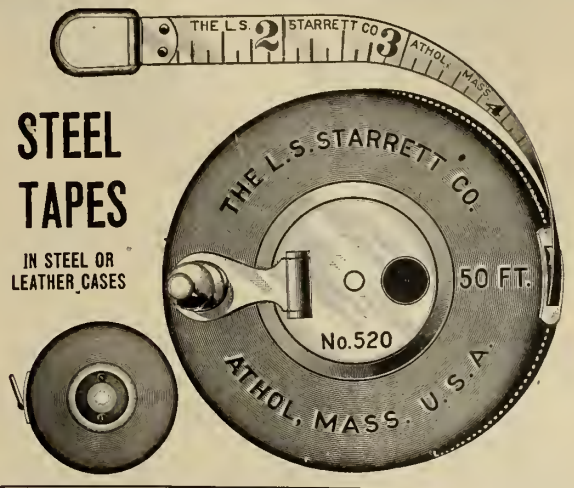

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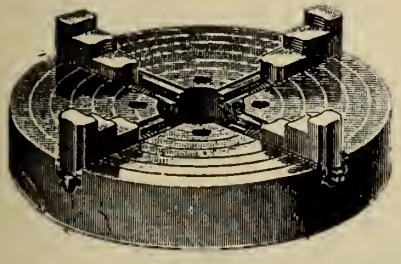

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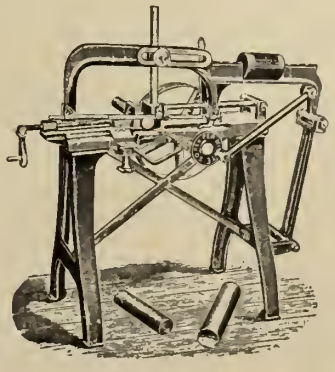

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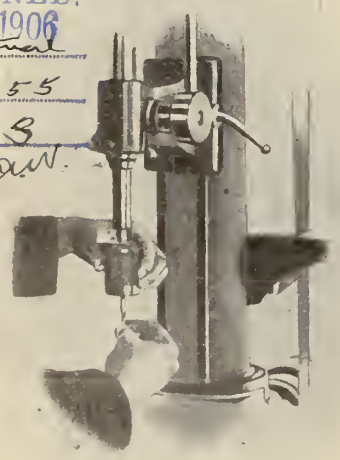

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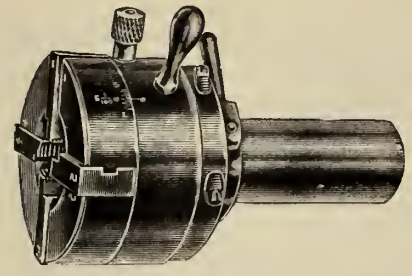

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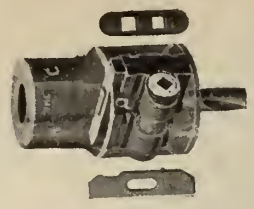

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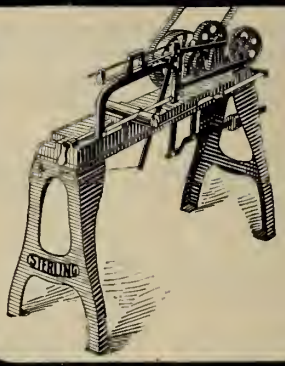

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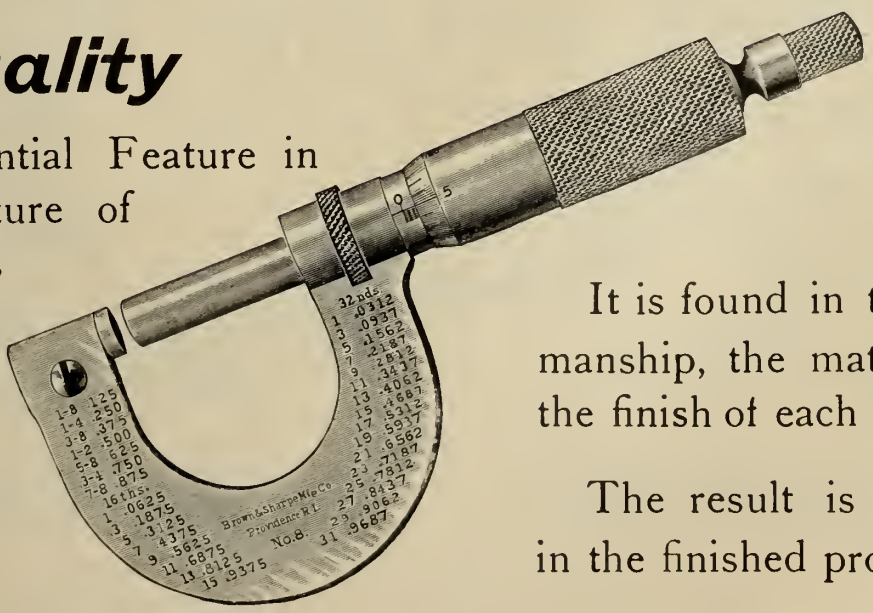

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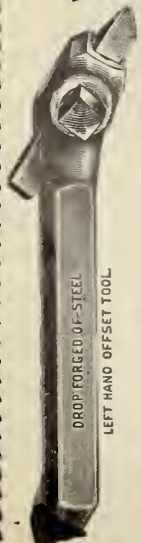

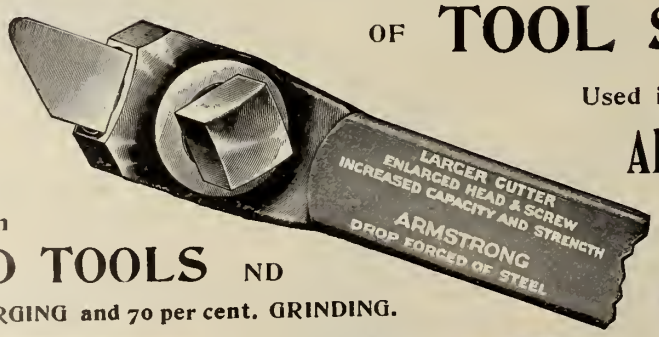

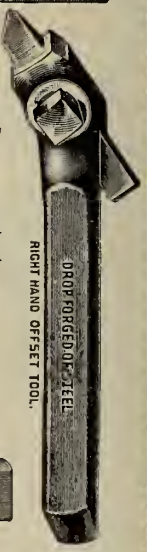

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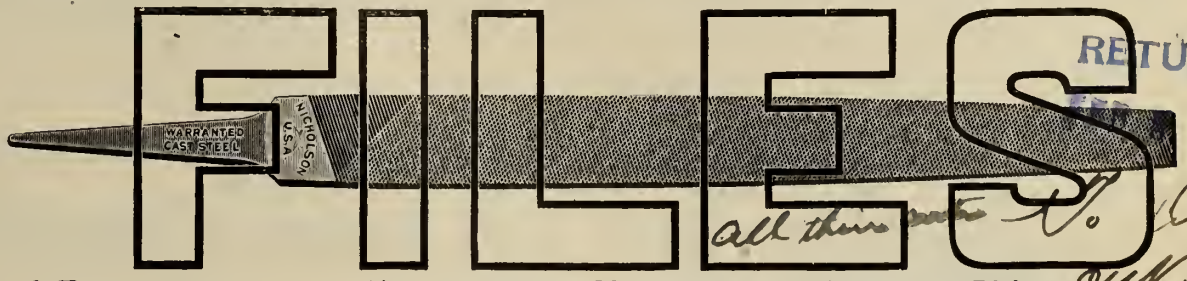

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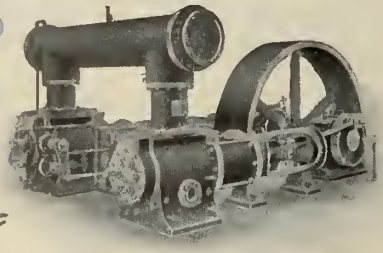

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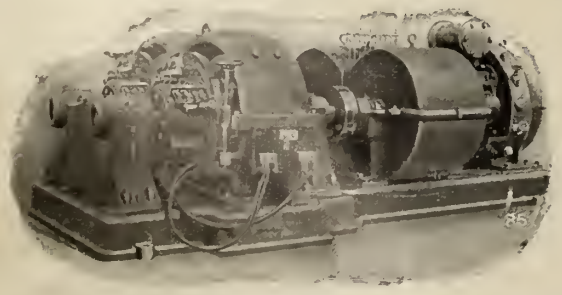

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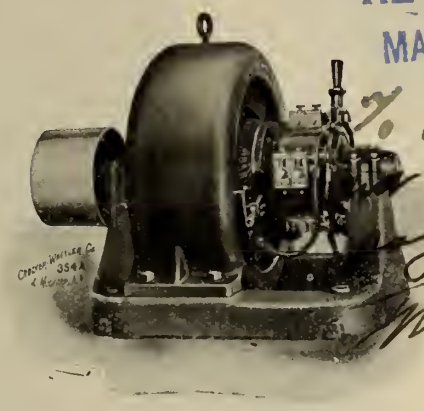

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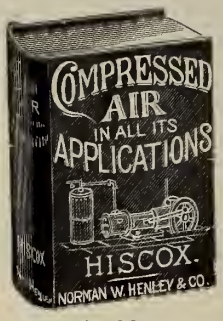

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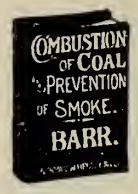

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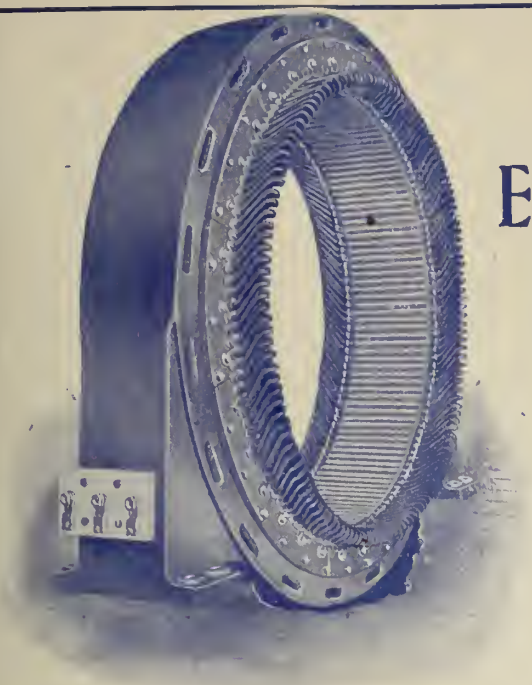

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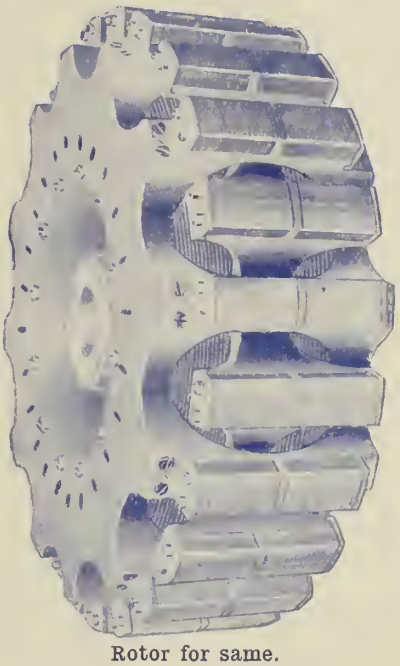

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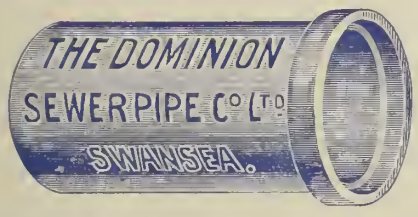

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Works : HAMILTON, ONT.

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AND MANUFACTURING NEWS

APRIL
1906

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Can three or four tool-makers using standard tools hope to compete with a plant equipped with the latest automatic devices, turning out daily the yearly product of the largest toolroom?

Send for new Small Tool Catalogue.

Pratt & Whitney Co.

WORKS: HARTFORD, CONN., U.S.A.

THE CANADIAN FAIRBANKS CO., Agents for Canada.

MONTREAL TORONTO WINNIPEG VANCOUVER

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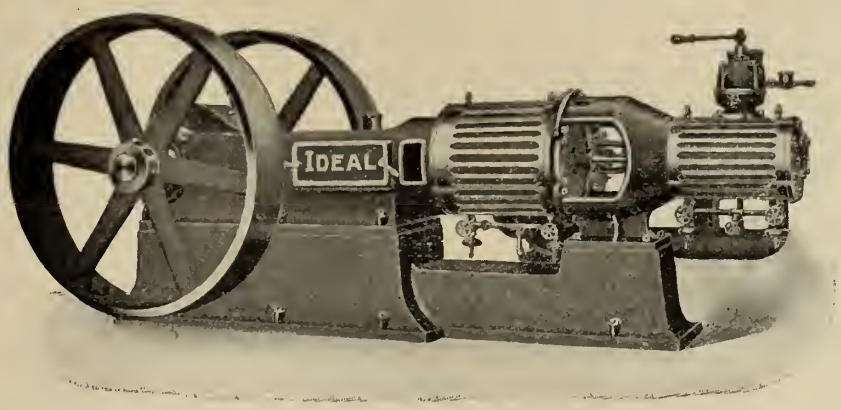
Perfection in High Speed Engine Design. Noiseless Running—Perfect Lubrication—Accessibility—Economy



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THE GOLDIE & McCULLOCH CO., LIMITED

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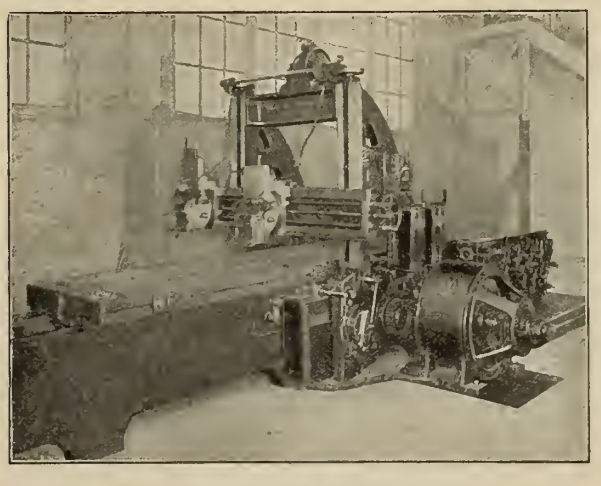
WE MAKE Wheelock Engines, Corliss Engines, Ideal High Speed Engines, Boilers, Pumps, Flour Mill Machinery, Oatmeal Mill Machinery, Wolf Gyrators, Emery Choppers, Woodworking Machinery, Shingle Machinery, Heading and Stave Machinery, Wood Rim Split Pulleys, Iron Pulleys, Shafting, Hangers, Friction Clutch Couplings, Friction Clutch Pulleys, Safes, Vaults, Vault Doors.

Westinghouse Motors

Increase Production

Individual drive permits the machine-tool being placed convenient to the work in hand.



Westinghouse Type S Motor Driving Planer.

Decrease Costs

Individual drive minimizes the cost of overtime work; only the tools in actual use consume power.

Canadian Westinghouse Co., Limited

General Office and Works, HAMILTON, ONTARIO

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WINNIPEG

Sovereign Bank of Canada Bldg.
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134 Granville Street
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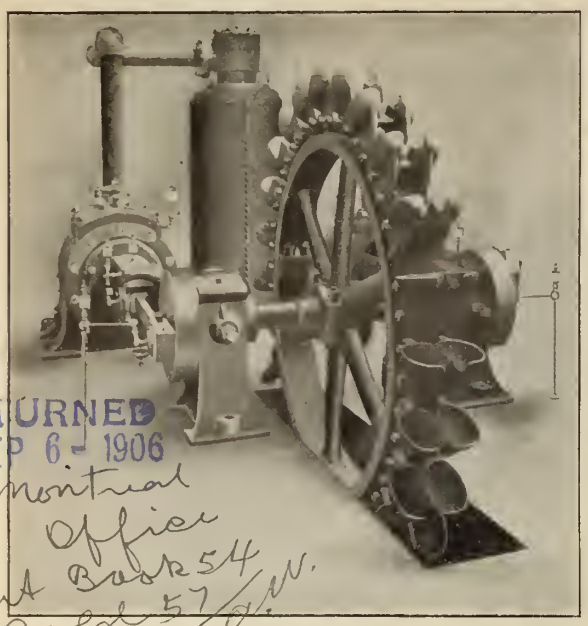
Small Doble Water Wheel



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OPERATING

Ingersoll Two-Stage Air Compressor Plant

There have recently been built four 8,000 horse-power Doble Tangential Wheels, the most powerful single water wheels ever operated.

Doble Water Wheels were awarded the Grand Prize at St. Louis World's Fair.

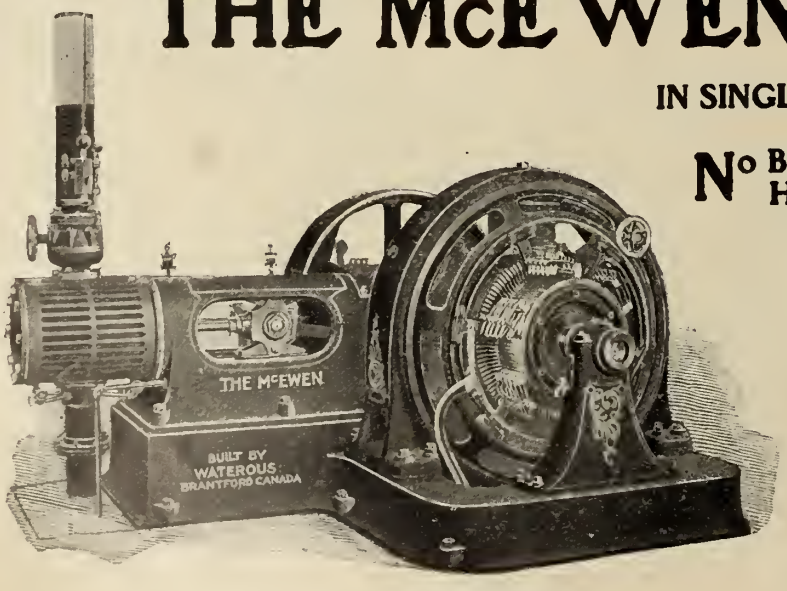
Write for our bulletins; they contain data and tables of value to engineers.

The John McDougall Caledonian Iron Works Co., Limited

Builders for Canada, **Montreal, P.Q.**

THE McEWEN High Speed Automatic

IN SINGLE AND COMPOUND UNITS



SIZES 15 TO 400 H.P.

No Better High-Speed Engine Built

GUARANTEE

'The engine shall not run one revolution slower when fully loaded than when running empty, and a reduction of boiler pressure from the greatest to that necessary to do the work will not reduce the speed of the engine one revolution."

This Guarantee cannot be bettered. Always see that it is equalled.

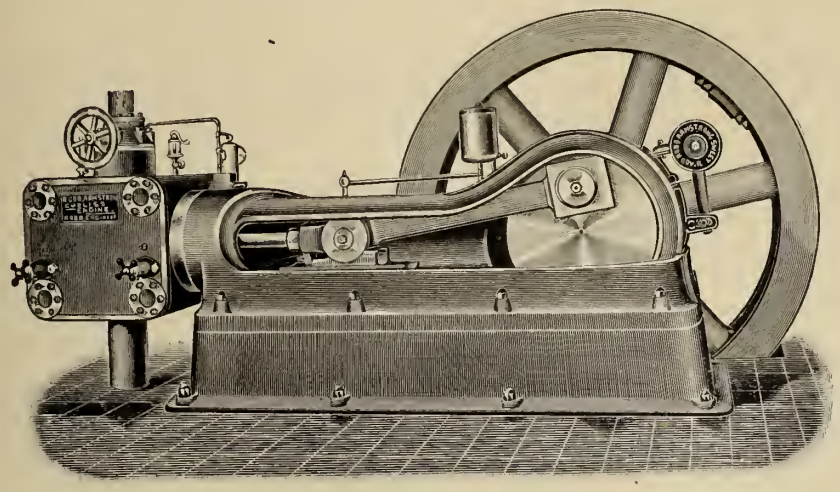
Waterous Engine Works Co., Limited

BRANTFORD, CANADA.

AN IDEAL STEAM PLANT

When you instal a power plant see to it that you get the best, the most efficient possible. Not only will it pay you, but it will give you unending satisfaction.

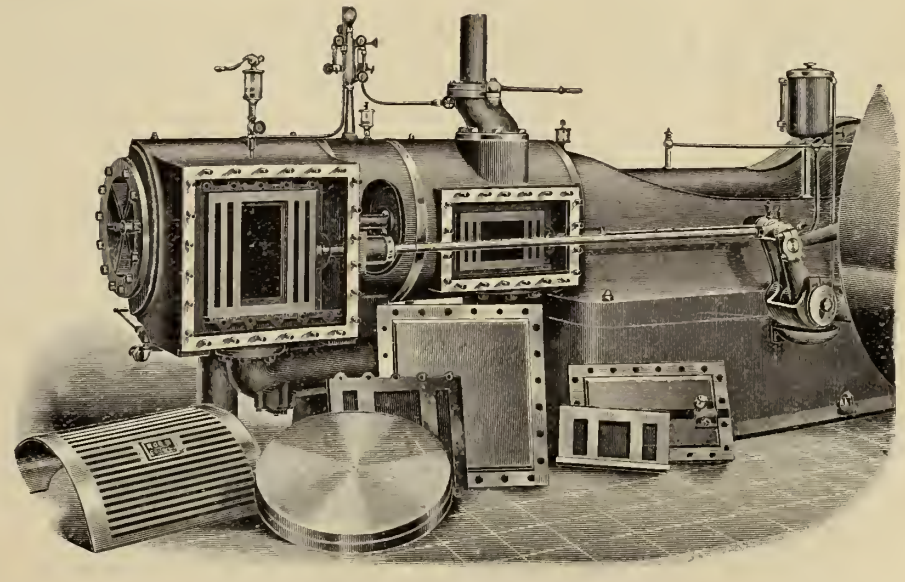
Note the following comment on a 350-horse-power Robb-Armstrong Corliss Engine and two 175-horse-power Robb-Mumford Boilers installed by us:



Medium Speed Heavy Duty Robb-Armstrong Engine.

"I will say without qualification that it is as fine a boiler and engine plant as I have ever had the pleasure of seeing for its size. The engine was working without heating and absolutely without any noise. I wish to congratulate you on your success in building this class of engine, and hope that we may have pleasure in dealing with you again."

Simplicity, Efficiency and Strength are Combined to the greatest degree in the Robb-Armstrong Corliss Engine



Robb-Armstrong Engine, showing valve seat.

Robb Engineering Company, Limited

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AGENTS

Wm. McKay, 320 Ossington Ave., TORONTO. Watson Jack & Co., Bell Telephone Building, MONTREAL.
J. F. Porter, 355 Carlton St., WINNIPEG.

LAURIE-CORLISS ENGINES

LAURIE ENGINE & MACHINE CO.
LIMITED

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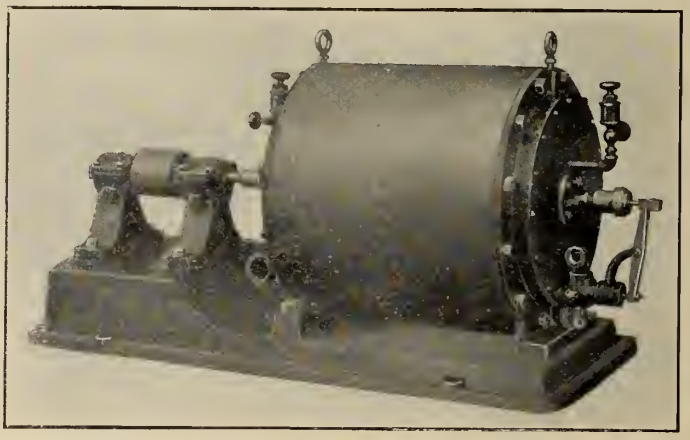
for general service in factories, power plants and public buildings. Condensing or non-condensing. Exhaust at any back pressure for steam heating, Direct coupled without gears to generators, centrifugal pumps and blowers.

Horse power 5 to 1000. Regulation close. Steam economy excellent and not changed by wear. No clearance and leakage troubles. Flooded lubrication of bearings without oil in the exhaust. No danger from water entrained with steam. High vacuum not necessary. Good results with ordinary jet and surface condensers.



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BUILT IN CANADA BY
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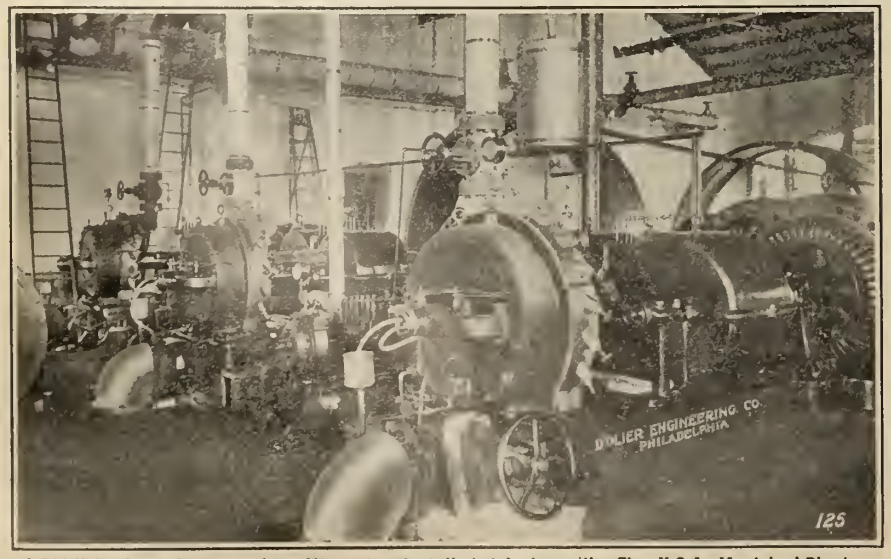

3-200 KW DeLaval Steam Turbine Alternators installed at Jacksonville, Fla., U.S.A., Municipal Plant

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Turbine Motors
Turbine Dynamos
Turbine Pumps

Highest Efficiency. *Long Life.*

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Sylvester Gasoline Engines

Are the best that skilled labor can produce.

They are easy starting; they are simple and reliable; they will give full power in the coldest weather. Made in sizes from 4 to 32 horse power in portable snd stationary and from 1½ to 12 horse power in marine. They will run on gasoline, coal oil or distillates.

The SYLVESTER Engine inspires confidence because it is so simple in construction. It is the cheapest engine to buy because there is nothing to get out of order.

The SYLVESTER Engine is handsome in appearance, substantial in construction, marvelous in simplicity, unequalled for effectiveness and durability.

THE HIGHEST AND MOST PERFECT TYPE OF GASOLINE ENGINE BUILT.

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THE SYLVESTER MFG. CO., Limited, - - LINDSAY, ONT.

Canada's New Lubricating Graphite

SAVES OIL SAVES MONEY
SAVES TIME SAVES WORRY

A perfect lubricating graphite is demanded by practical engineers and those responsible for keeping machinery in motion. **Time is saved. Power is saved. There is no worry where Canada's New Lubricating Graphite is used. There is no equal.**

You must use only the the best "air-floated" Graphite. Ours is an impalpable POWDER, free from grit or any sort of impurity.

No journal will be damaged from over-heating or kindred cause if you use Canada Graphite, for unlike oil it associates itself with one or other of the rubbing surfaces, it enters every crack and pit and fills them. If the surfaces are ill-shaped or irregularly worn, the Graphite fills in and overlays until a new surface of a regular outline is produced.

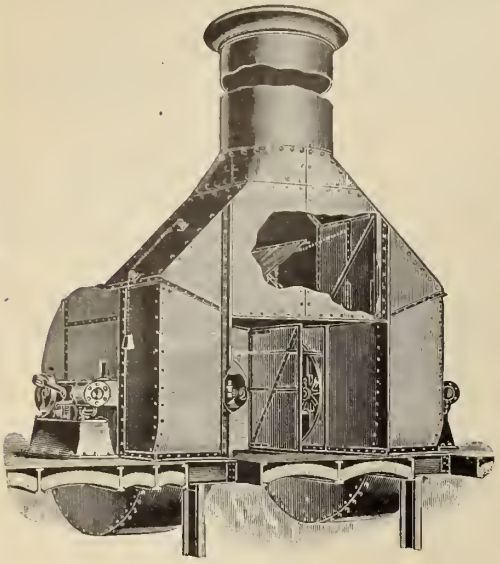
Watch for our Ads. and we will interest you. they will convince you that we can save you money. Write for our Catalogues, Booklets and Samples,

The Economical Mfg. & Supply Co., Limited

Manufacturers and Dealers in Power Users' Supplies,
Canadian Agents for The New York Belting and Packing Co., Limited,

171 Queen St. East, Toronto, Canada

Fans and Blowers for Induced and Forced Draft



Drying Systems of all kinds for drying any material.

Shavings Exhaust Systems installed complete.

Dry Kiln Trucks and Wheels, Lumber Dryers, Brick Dryers, Steel Brick Cars, Transfer Cars, Turntables, etc.

Stationary and Portable Forges, Cupola Blowers, Exhaust Fans, Planing Mill Exhausters, Dust and Shavings Collectors, and Steam Specialties such as Back Pressure Valves, Oil Separators, Exhaust Heads, etc.

Vertical and Horizontal Steam Engines.

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There's Nothing Too Big in the Blower Line

for us to build, whether for ventilation or mechanical dratt. Large or small, they are all built to the same high standard establishment by B. F. Sturtevant and maintained through nearly half a century of progress.

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Designers and Builders of Heating, Ventilating, Drying and Mechanical Draft Apparatus; Fans, Blowers and Exhausters; Steam Engines, Electric Motors and Generating Sets; Fuel Economizers; Forges, Exhaust Heads, Steam Traps, etc. 496

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THE WORLD'S STANDARD

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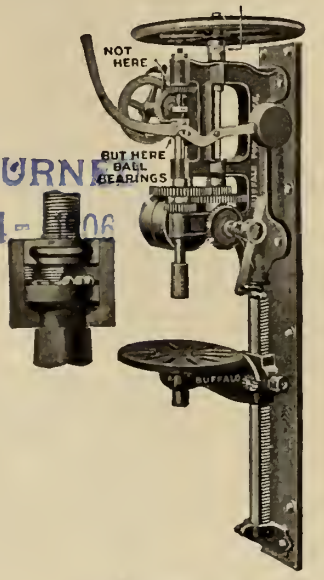

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Steel Plate Fans for Heating and Ventilation Drying and Mechanical Draft

The best results are only possible when installations are designed and executed by specialists.

Buffalo goods have been placed all over the world and the experience of 25 years in handling fan problems is yours for the asking.

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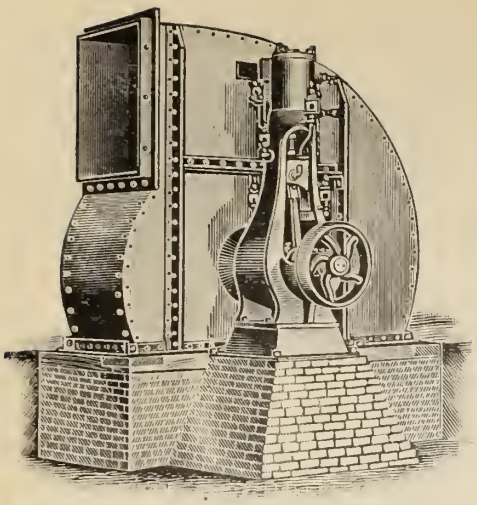

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HOT BLAST HEATING SYSTEMS for BUILDINGS of ALL SIZES.

PATENT STEAM HEATERS that give FULLY 25% MORE EFFICIENCY than others in the market.

PLANING MILL EXHAUSTERS and DUST SEPARATORS of IMPROVED PATTERNS.

Drying Systems for material of every description.
BLAST SYSTEM OR OTHERWISE.

Fans and Blowers for all purposes.

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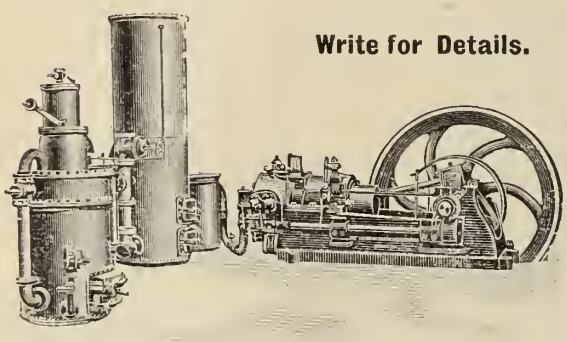
McEachren Heating and Ventilating Co., - Galt, Ont.

Suction Gas Power Plants

5 to 500 H. P. Units.
Fuel Cost $8.00 per H. P. per Year.

Six of our plants in operation or under erection in Canada.

Write for Details.



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321 St. James St., **MONTREAL**

High Grade
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15″ x 6′ Engine Lathes
15″ x 8′ " "
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Quotations cheerfully submitted

CANADA MACHINERY AGENCY
W. H. NOLAN, Prop. **MONTREAL**

Enlarged Facilities.

Our new plant at St. Catharines is now ready to turn out boilers. We are consequently in a position to handle a greatly increased volume of Boiler business and to handle it with dispatch.

With a view to rapid and economical production, no expense has been spared in equipping the new plant. It is modern and complete in every particular. You are particularly requested to send us your Boiler enquiries.

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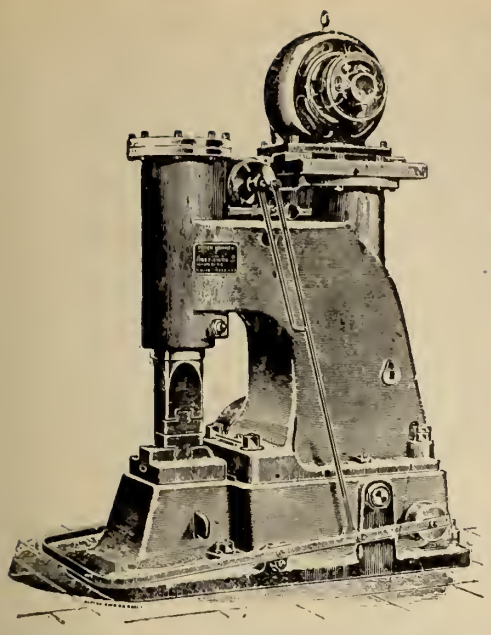
Plants : { **SHERBROOKE, Que.** / **ST. CATHARINES, Ont.**



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Driven by Electric Motor or from Line Shaft

Used by all the Principal Engineering and Shipbuilding Works, Railway Companies, Mines, etc.

ALSO NEW COMPRESSED AIR HAMMERS

Worked from Separate Compressor.

We can save you over 50 per cent. in power consumption as compared with other types.

These Hammers have Compound Cylinders and require a surprisingly small quantity of air.

HAVE YOU STEAM HAMMERS?

We can convert them to our new type AIR HAMMERS.

Send for "H" List

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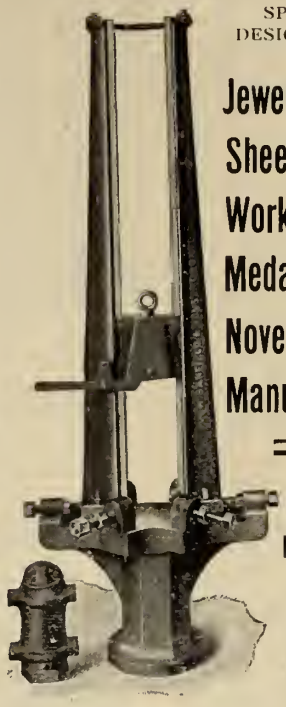

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Jewelers, Sheet Metal Workers, Medal and Novelty Manufacturers

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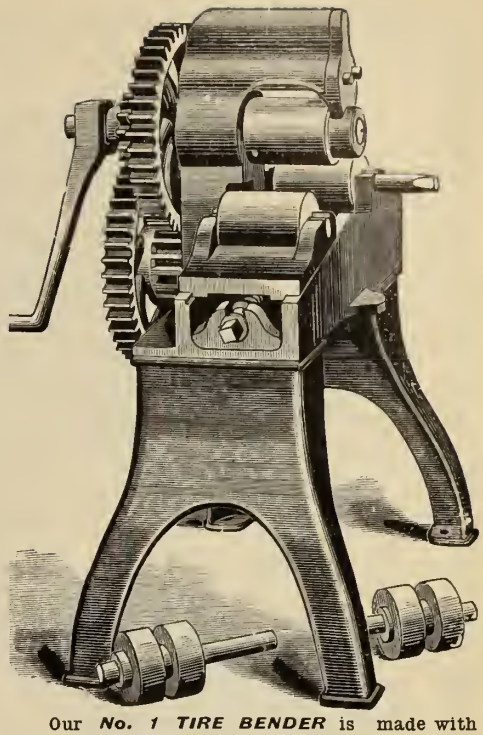
DIES, TOOLS, AND SPECIAL MACHINERY

W. H. BANFIELD & SONS

120 Adelaide Street West, TORONTO.



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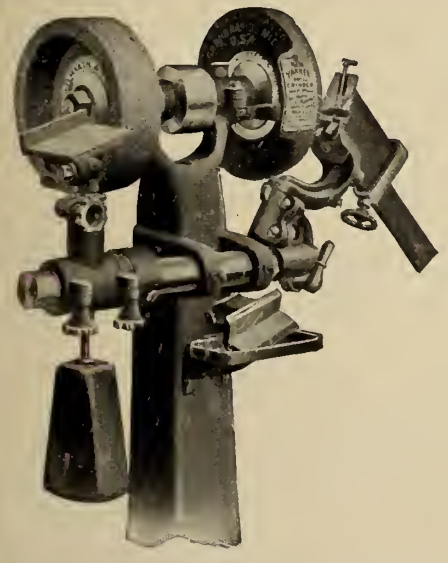
BOYNTON & PLUMMER, WORCESTER, MASS., U. S. A.



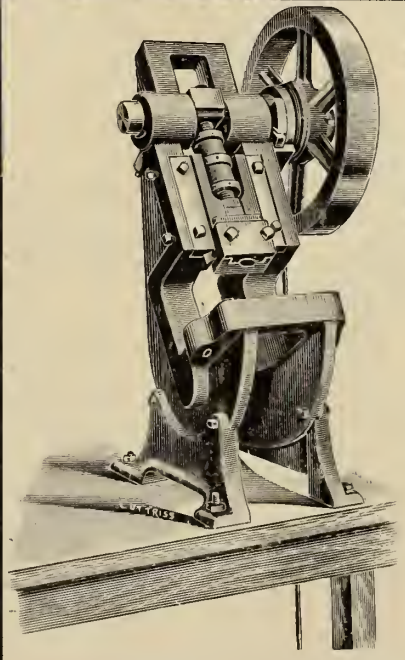
Besides Grinding Drills This Machine Will Do a Thousand and One Jobs

grinding that cannot so well nor so cheaply be done in any other way. That accounts for the large number sold. It makes every drill in your shop do ***more*** and ***better*** work, and do it ***quicker,*** and then, you know, a ***properly*** ground drill is hard to break.

Incidentally, every hole you drill is made ***cheaper*** and ***better to size,*** and we'll leave you to judge what that's worth to you, in your shop. We have printed matter that explains more fully than space permits here. May we send it?

WILMARTH & MORMAN CO.

577 Canal Street, - Grand Rapids, Mich.



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Canadian Made

ALL SIZES

For Stamping of all kinds

Equipped with instantaneous four-point clutch

Also Tinsmiths', Cornice Makers', Metal Workers' and Canners' Machinery.

Manufactured by

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Special Representative:

W. T. STANDISH, - - Toronto

DODGE

FRICTION CLUTCH MECHANISMS

SPLIT AND SOLID

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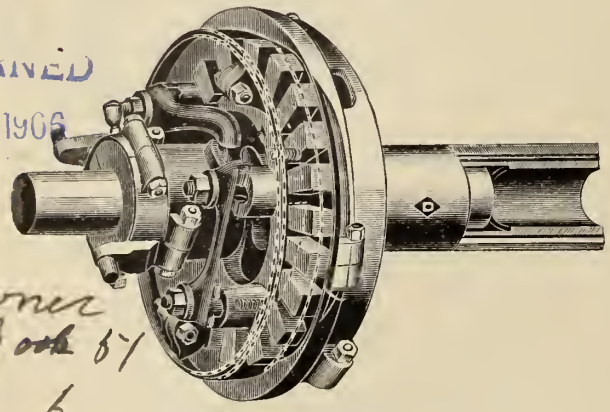
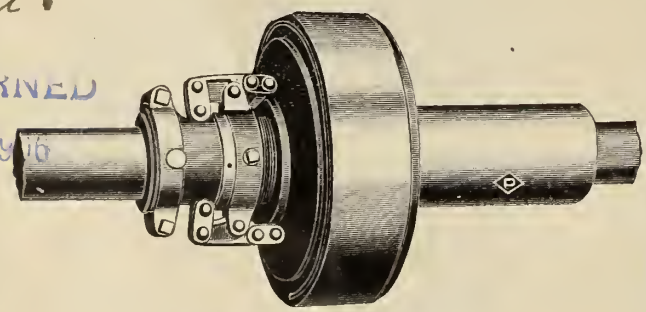


Dodge Spiit Friction Clutch

The only Split Friction Clutch on the Canadian market, which is manufactured on standard lines, all parts interchangeable—and carried in stock for quick shipment. Our patterns are complete for sizes 10 H.P. to 600 H.P.



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We manufacture this clutch in large quantities, in sizes from 6 in. to 16 in., capacities 2 H.P. to 50 H.P. All parts interchangeable and carried in stock for immediate shipment.

THEY CARRY ANY MAKE OR STYLE OF PULLEY.

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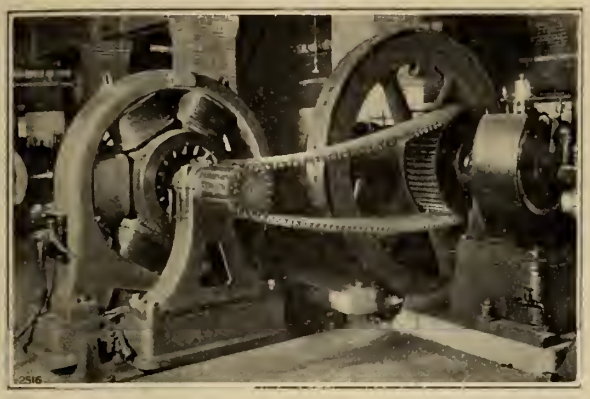

150 H. P. motor driving air compressor at New Lasalle St. Station of Rock Island R. R., Chicago.

Renold Silent Chain

is the only bushed chain of its type in existence. ***THE PIN ROTATES,*** distributing the wear evenly at the joints—a detail that helps to make this chain the most durable as well as the most effective power transmitter yet devised.

Let us send you Booklet "J" and Bulletins 50, 52 and 58.

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The Link-Belt Machinery Co.
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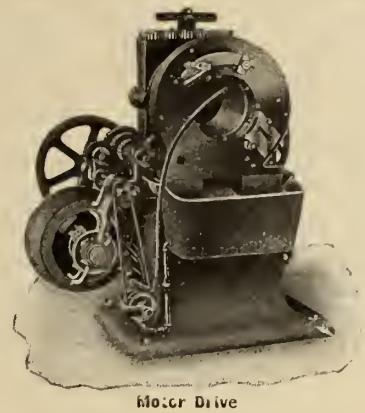

Motor Drive

Merrell Motor and Engine Driven Machines

These machines are the regular combination hand and power machines having motor directly attached. While the cut shows machine without hood, in order to illustrate the method of attaching, there is a hood provided which covers the gearing completely and affords protection to the gears from chips and dust. These machines are to be had in four sizes and will do far more rapid work, both in threading and cutting off, than any other combined machine on the market.

Would you like a copy of our Catalogue?

THE CANADIAN FAIRBANKS CO., LIMITED

Sole agents for Canada

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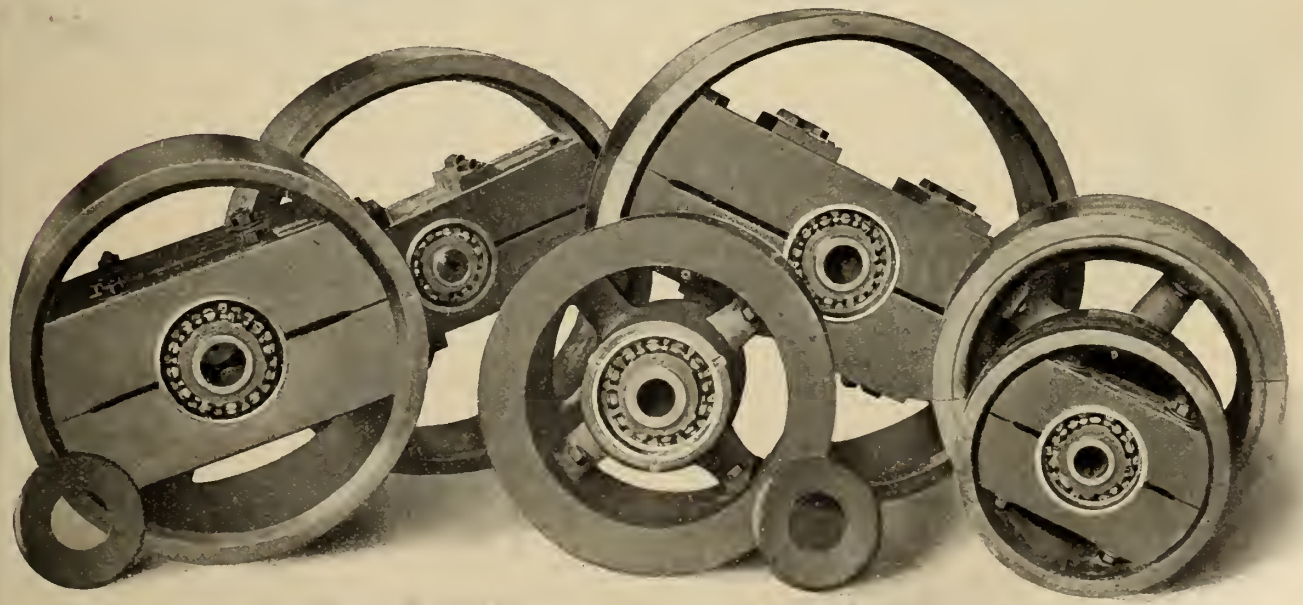
HAVING TROUBLE WITH YOUR LOOSE PULLEYS?

Chapman Double Ball Bearing Pulleys will not heat nor cut, will not ruin belting by throwing oil and are guaranteed to give satisfaction.

SPECIFY THEM IN YOUR NEXT ORDER FOR

WOOD-WORKING MACHINERY



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THE CHAPMAN DOUBLE BALL BEARING CO. OF CANADA, LIMITED

OFFICE—39 SCOTT STREET. FACTORY—39 PEARL STREET, TORONTO.

LONDON MACHINE TOOL CO.

LONDON, - ONT.

Manufacturers of HIGH-GRADE.... **MACHINE TOOLS**

Can equip our Machines for Motor Drive.

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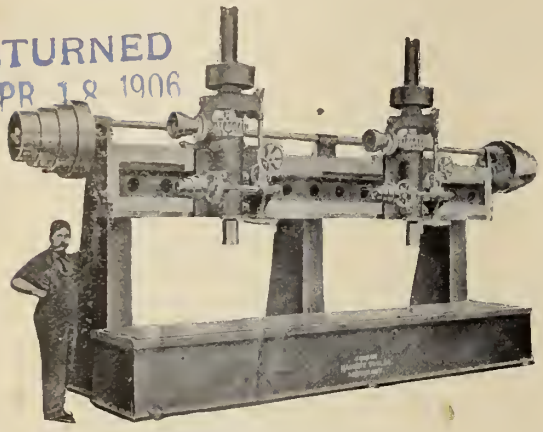

Dup'ex Rod Boring Machine.

Lathes,
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Shapers,
Steam Hammers,
Drop Hammers,
Plain Drills,
Radial Drills,
Boring Mills,
Presses.

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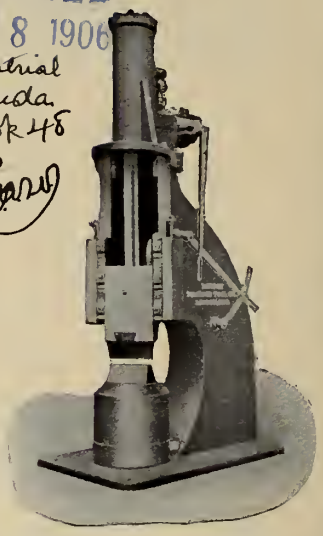
to Industrial Canada. Cut Book 48 Page 97



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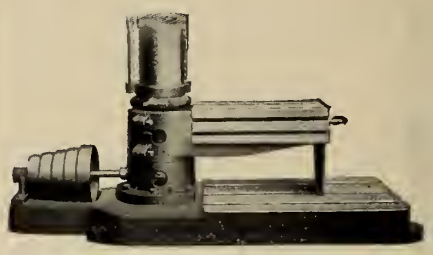
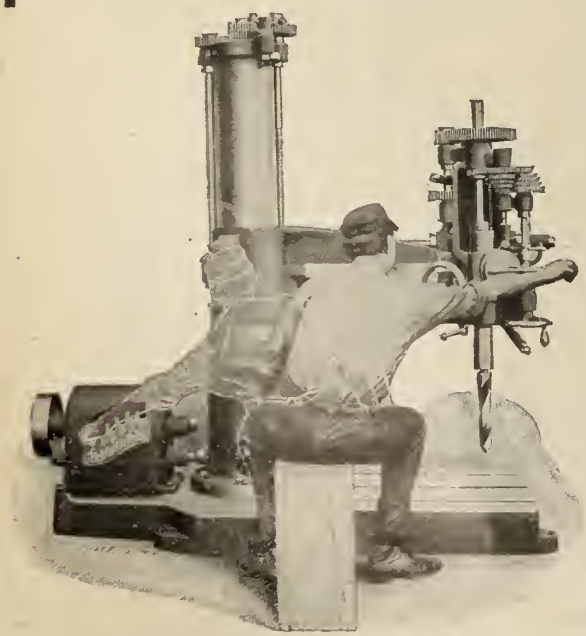
than any Upright ever built—our 30-in. RADIAL DRILL. Costs but a trifle more and is admirably adapted to light and medium manufacturing, being particularly effective in taking care of the ordinary work as found in the average shop.



Cone Drive and Swinging Table.



Bickford 30"-36"-42" Radial Drill.

A Few Features

12 speeds when driven through a speed box; 10 when a cone is used.

Tapping attachment incorporated in the design of the head.

Fitted with any one of six styles of tables.

Circular 1-A for the asking.

The Bickford Drill & Tool Company

Cincinnati, Ohio, U. S. A.

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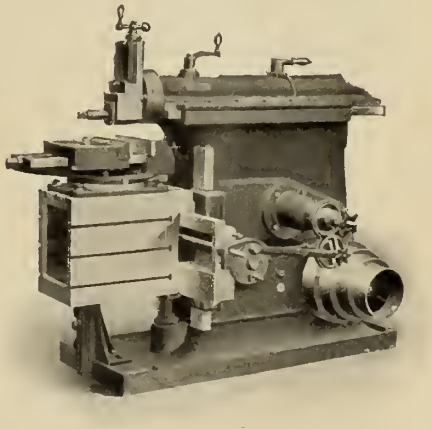

Sizes—16", 18", 21", 24", 28".

THE NEW "AMERICAN" SHAPER TAKES HEAVIER CUTS THAN MOST PLANERS. THINK OF IT!

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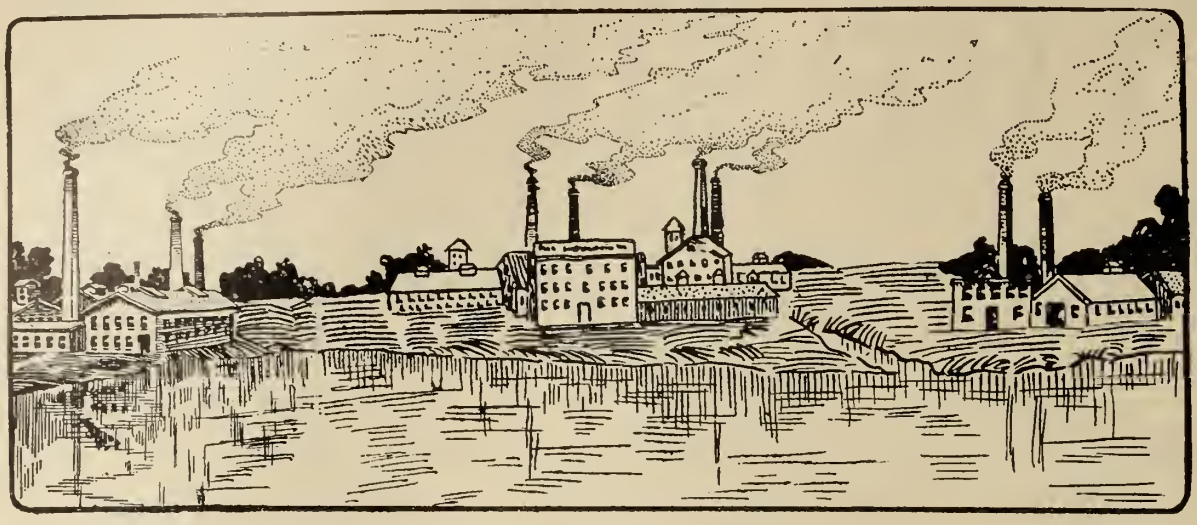

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with a branch house at Montreal to facilitate business at that end, and our own workshop for making all necessary repairs. We guarantee everything in good condition, and surround the business with every possible courtesy.

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GEO. H HOWARD, Dundas, Ontario

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Cleveland, O.

Potter & Johnston Machine Co.
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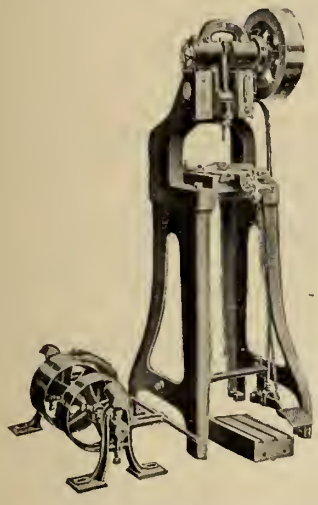

to know how useful and handy is this **KEY-SEATER.**

We can't get along without it in our shop, and if you had one in your shop, you would think so too.

It cuts small internal keyways in gears, pulleys, etc., and does the work in a most rapid and pleasing manner.

Cut shows machine complete with Pedestal, but we can furnish it in bench style if desired.

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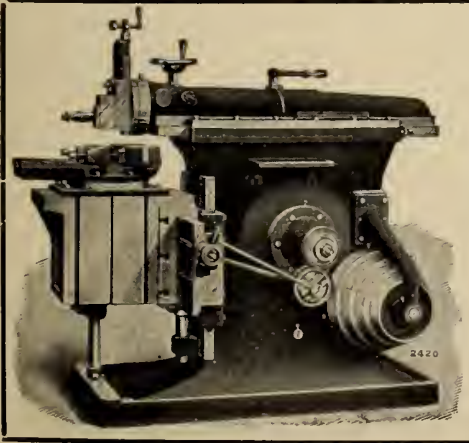
Converts a Lathe into a Horizontal Boring Mill.
Increases your shop equipment at small cost.
Saves hundreds of dollars on the price of an expensively installed Boring Mill.
Equals a Boring Mill in quality and quantity of work within range.
Weight of attachment for 30-in. lathe, 685 lbs.

Made in all sizes by

H. B. UNDERWOOD & CO.
1035 Hamilton St., - Philadelphia, Pa.



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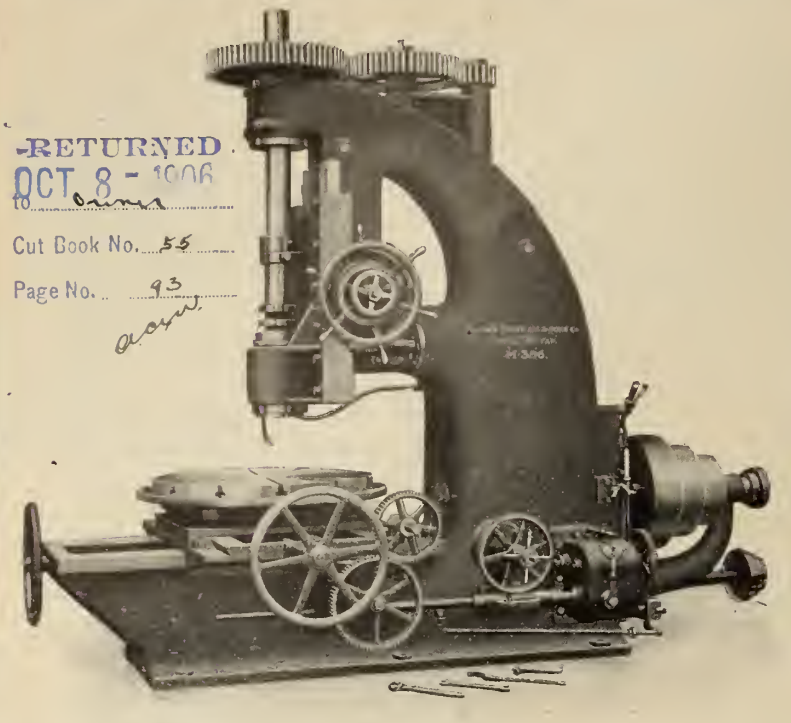
Are built to stand the excessive strains caused by heavy cuts and big feeds with high-speed steels. All sliding bearings have taper gibs, adjustable endwise by single screws, and the crank block is drop forged. A high-gear ratio, an ample amount of cast-iron properly distributed, and high-class workmanship, combine to place the "CINCINNATI" in the front rank. Catalog on request.

THE CINCINNATI SHAPER CO.

CINCINNATI, OHIO, U.S.A.

Canadian Agent: - H. W. PETRIE, - Toronto, Ontario

The Bertram Vertical Milling Machine



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Canada

Has a spindle 5 inches diameter

and a combination of strong points which makes it the most powerful machine of its kind built. Attention is called to the powerful train of gear, making it possible to obtain a cutting force of 21,000 lbs. at the circumference of a milling cutter 5 inches in diameter. It has quick-change gear, all of steel. The driving cone has three steps for a 6-inch belt and has 12 changes of speed. All feed motions are conveniently located so that the operator need not leave the working side of the machine. The spindle has a vertical movement. The circular table is provided with power rotary, cross and longitudinal feeds, which are reversible as well as hand adjustment. For fuller information regarding this or any other of the Bertram lines of machine tools, write to

THE

John Bertram & Sons Co.

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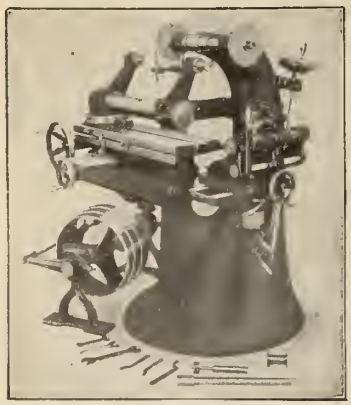
DUNDAS, Ontario, Canada



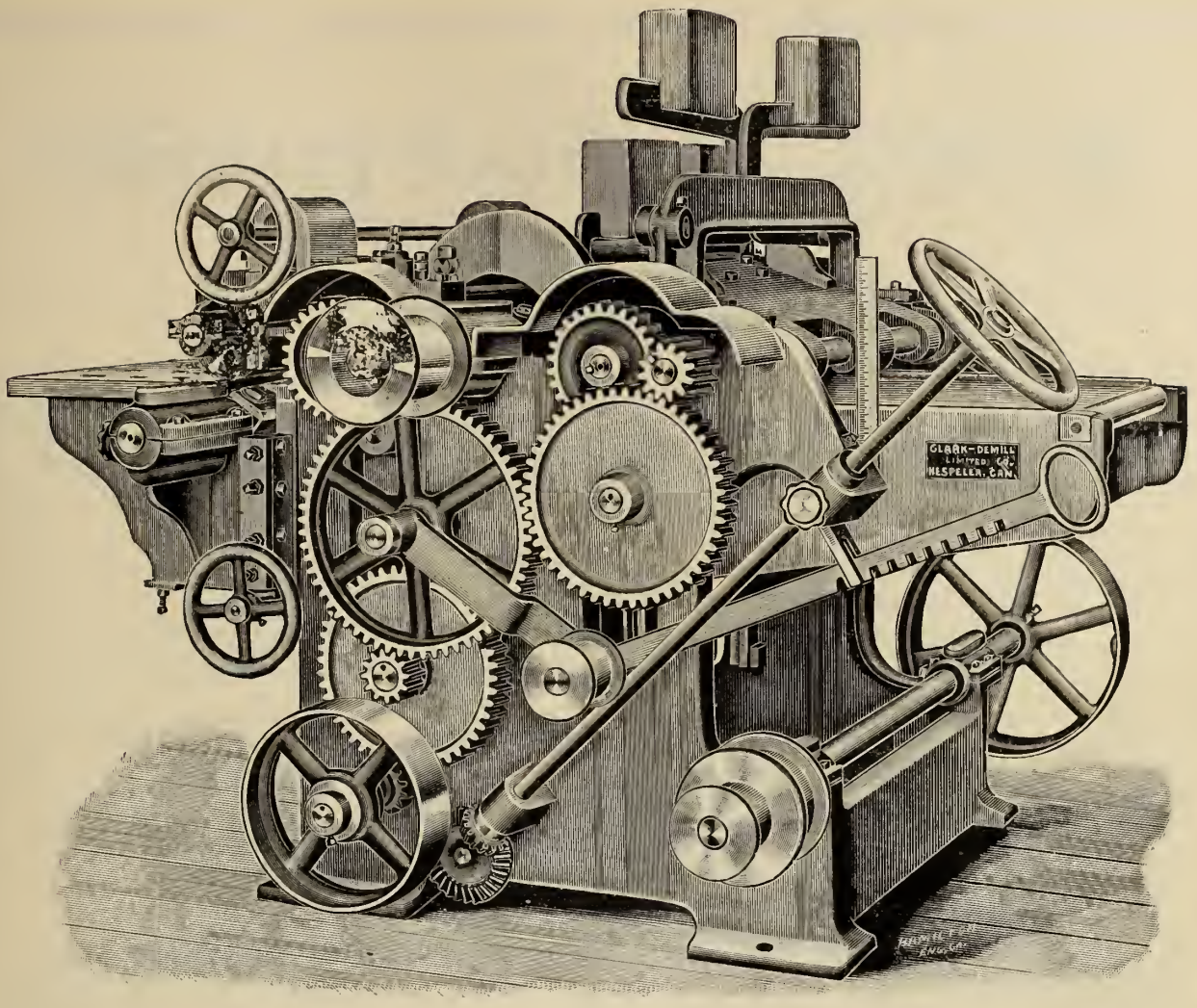
No. 1-14 Cutter and Reamer Grinder.

WE HAVE A FEW OF THESE MACHINES READY FOR IMMEDIATE DELIVERY

This machine is distinctly a cutter grinder, and was designed to fill the want for a machine to sharpen milling cutters of all kinds and shapes, without special fixtures or special-shape emery wheels, being heavy enough to eliminate all vibration and still be easily operated. It weighs about 1370 lbs. The table, which has a long bearing on the saddle, has a longitudinal feed of 20 in., cross adjustment of 7 in., with a vertical adjustment of 6 in. Cutters 1 in. to 14 in. can be taken between centres. The table can be used at different angles with the spindle in horizontal plane, by swiveling the knee around the column. The machine is compact, durable, adaptable and a necessity for the busy shop.

Becker-Brainard Milling Machine Co.

HYDE PARK, MASS.



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If this machine is not heavy enough for you, why, we make heavier, and will be pleased to tell you about them.

All work guaranteed to be of the highest order.

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Page 95
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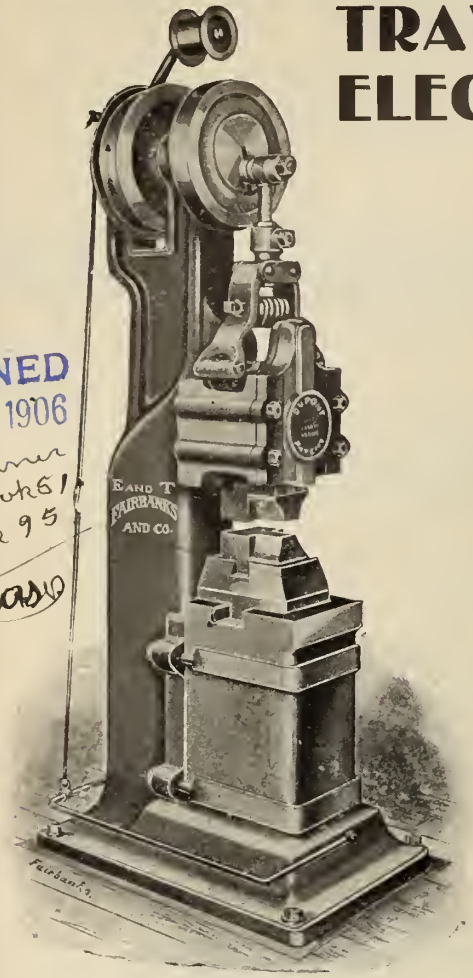

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"A Hard Hitter"

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We represent

The Leading Machine Tool Manufacturers in America

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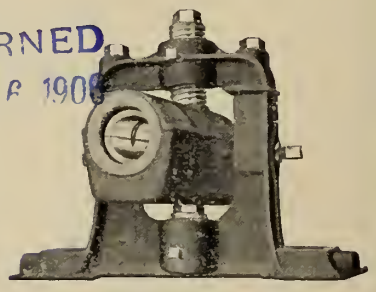

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Pumping Machinery for all purposes

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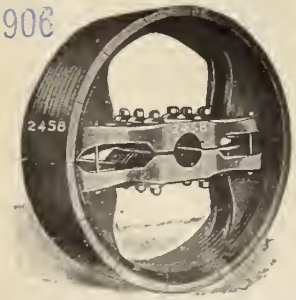

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MONTREAL TORONTO WINNIPEG VANCOUVER

Modern Canadian Manufacturing Plants.

ARTICLE XIV.—The Standard Bolt & Screw Co., Limited, Toronto.

IN October of last year the Standard Bolt & Screw Co. was incorporated for the purpose of manufacturing what is known to the trade as milled goods, such as cap screws, set screws, machine bolts and nuts. The business was started by Mr. F. S. Jackson, for many years connected with the Diamond Machine & Screw Co., and since commencing operations Mr. Jackson has taken control of the shop and acted as superintendent. The officers of the company are: President, A. A. Dickson; vice-president, Dr. John Ferguson; secretary, P. S. McKergow.

Building and Plant.

Manufacture is carried on on the lower floor of the large new factory at the corner of Sorauren avenue and Dundas street, which is of solid brick on concrete foundations, the building being of slow burning mill construction. The plant is admirably suited for this work, being bright and cheerful and particularly well lighted. The main floor is 60 by 150 feet with separate office. At present there are about 18 machines in operation, most of which are Cleveland & Hartford automatic, but it is intended within the near future to add about 14 more of these machines, the space available being shown in the foreground of the view giving the power plant.

A new building is proposed and at present under way to be of concrete and fire-proof throughout, situated on the railway siding near the present factory, for the purpose of manufacturing hot and cold nuts and screws. This building, of which the end view is shown, will be capable of accommodating 60 automatic machines, together with hot and cold nut and bolt plants, consisting of presses and furnaces. This building is to be equipped with the latest labor-saving devices known, one of which will be an industrial railway running between the rows of machines for bringing in raw material and transporting the boxes of finished goods.

Raw Material.

When manufacture was first commenced considerable difficulty was experienced with the raw material from which the different lines manufactured here were to be made. Different lots were tested and experimented with and finally abandoned, until finally a suitable product was obtained for the highest class of manufacture. The stock used is round and square, from one-quarter to inch and a half, and hexagon from three-eighths to inch and a half, both iron and steel, the iron being used

RETURNED
APR 27 1906
T. Owen
our book 49
page 54
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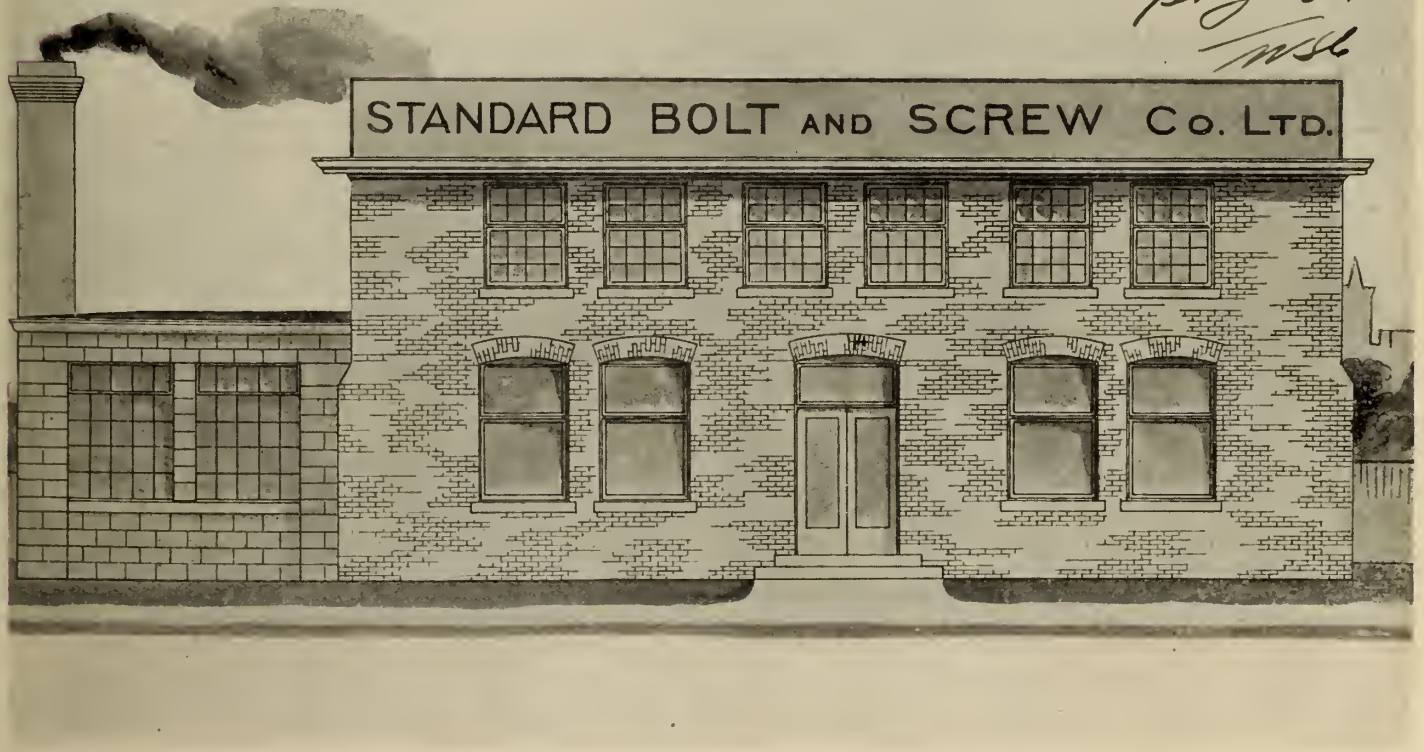


Exterior View of New Plant—Standard Bolt & Screw Co., Limited, Toronto.

for case hardened set screws and the steel for cap screws, nuts, etc.

The power plant is situated in the southern end of the building, being under the control of the Southern Light & Power Co., whose plant at Erindale is now in course of construction. When the new building has been erected the firm will have its own power plant on the premises.

Manufacturing.

As will be seen from the two views illustrating installation, the machinery is conveniently arranged to afford

found a description of making cap screws by the latest method known.

It might be mentioned in passing that a screw plant running automatic machines necessarily requires a large amount of capital to instal it. The actual making of these goods is of considerable interest, one reason for this being that the machines run and turn out the finished product without the attention of a skilled mechanic.

Making Hexagon Cap Screws.

With one man to supervise the plant the remainder of the attendants may be

vances forward slowly but surely and mills this hexagon bar down to about $\frac{1}{2}$ inch in diameter and within $\frac{7}{8}$ of an inch of the cutting off place. This is called the roughing cut. The turret recedes and makes another partial revolution when a second hollow mill or cutter advances a little more rapidly this time. This is called the finishing cut and makes the screw exactly $\frac{1}{2}$ in. in diameter. The turret recedes again and makes another partial revolution, this time advancing with a circular tap which cuts the thread on the screw whatever length may be desired. When

Standard Bolt & Screw Co., Limited—Interior view looking north

greatest convenience to the attendants and for lighting. The machines are all run by motors, situated at convenient points running the two lines of shafting to which the different rows of machines are belted. The class of machines installed has already been mentioned and these are capable of turning out all classes and varieties of screw work, including bolts and screws of every description, loose ledger binding posts and gas engine valves. Each machine has a capacity of 150 to 800 screws a day according to size. It would be interesting to follow the course of manufacture in this plant and following will be

limited to a few men of but small experience. In watching the operation it was noticed that a workman placed a hexagon bar of steel about 12 feet long in one of the automatic machines, this bar being $\frac{7}{8}$ of an inch in diameter. The machine was then started and the first movement was for the bar to be carried forward about four inches. A revolving head or turret makes a forward movement in the opposite direction. This forces the bar of steel back a little and allows only $2\frac{7}{8}$ in. of the bar to be left to be operated upon. Another motion of the revolving head then takes place and a hollow mill or cutter ad-

the thread has been cut on the screw the machine takes on a backward motion and recedes, allowing the screw to remain intact with the full thread upon it. A side motion then occurs and a tool advances and cuts off this screw, leaving the bar ready to go forward again for another one. During the time this is going on a small rotary pump is constantly pumping oil on the screw while it is being made. This oil is used over and over. Practically no loss occurs but from evaporation.

The screw just made is then placed in a vat of hot alkaline liquid which cuts off any little oil or grease which may

adhere to it. The sides are then ground off smooth and placed in the shaving machine which finishes up a 2 in. x § in. hexagon head cap screw ready to be packed and shipped to the customer.

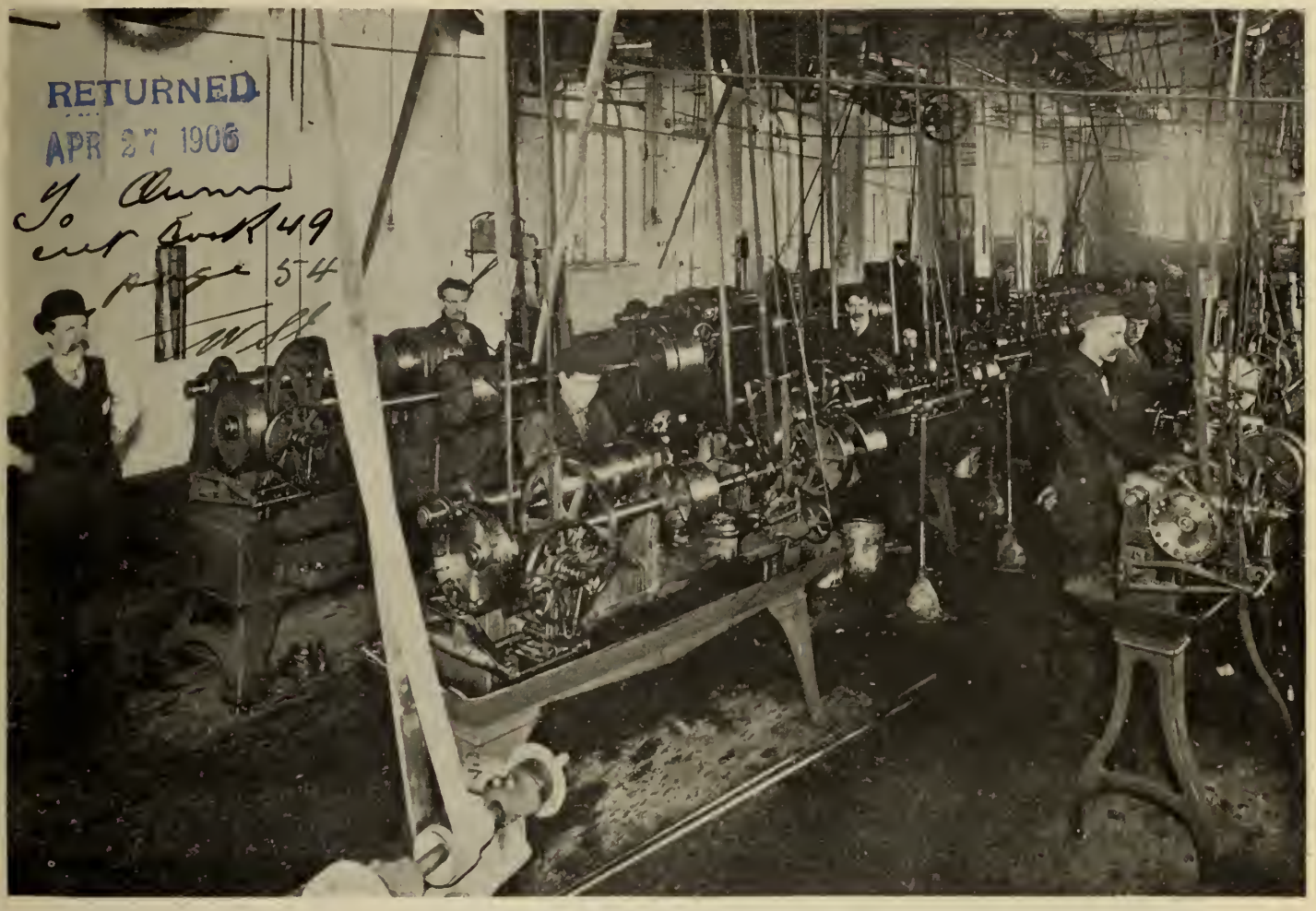
A machine of this type is capable of turning out hundreds of these screws in a day, and can be readily changed to produce screws of different sizes and lengths according to the requirements of the trade.

Set screws are made in a somewhat similar way, only the bar out of which they are manufactured is square. In some cases the point of the set screw is hollow or cup pointed, as it is called, and in others sharp pointed.

After the screws have been made and the heads finished they are then packed in boxes with charcoal, bones, etc., and placed in a furnace heated to a high degree of heat, and when they have been subjected to this heat the necessary length of time they are then plunged into cold water. This heating and cooling of them is called case hardening, which leaves the screw comparatively soft and tough on the inside while the outer portion is so hard that it cannot be filed or cut in any way. These screws are then packed in regular sized boxes ready for shipment.

All varieties of screws are made which are known to the trade as milled goods and the whole operation is very interesting and instructive, especially as one workman was attending to six of these automatic machines, placing in fresh bars as they were required and seeing that the machines were performing the duties which they were intended to do.

These machines never get sick; and are always ready to start their work when the power is applied to them. They never go on strike, all they ask in the form of wages is "Feed me with iron or steel bars and give me power and oil and I will do the rest."



Standard Bolt & Screw Co., Limited Interior view, looking south

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DON'TS FOR MACHINISTS.

Don't blow into a hole that has dirt at the end of it.

Don't be afraid to tell your new ideas to your foreman.

Don't finger a piece of work while filing it in a lathe.

Don't use the side of your hammer to drive anything with.

Don't think all machinists are worth the same rate of pay.

Don't take advantage of your foreman's absence to "cut up."

Don't use a hollow-backed chisel for cutting oil channels.

Don't use a fine pair of dividers on rough and sandy scale.

Don't forget that O. K. means "Oll Korreekt," or all correct.

Don't try to grind a plug valve to a seat with coarse emery.

Don't try to make a flat surface with the tip of a file.

Don't think that a farmer boy cannot learn to be a machinist.

Don't file a piece of work when it chatters beneath your file.

Don't use a hard hammer to drive a mandrel into a piece of work.

Don't stop your machine while in the midst of a finishing cut.

Don't cut a rawhide gear on slow speed, as a fast speed is much better.

Don't gage the amount of work you do by the amount of pay you receive.

Don't mark fine tools with steel letters—squares and scales especially.

Don't forget that large pieces of cast iron may be bent by peening them.

Don't throw away all the short butt ends, when you are cutting up stock.

Don't bore out the lathe chuck when you are boring a piece of work in it.

Don't put a lot of "gingerbread" polish on work that does not require it.

Don't set a tool to take a finishing cut, without using an oilstone on it.

Don't try to rough out and finish large screw threads with the same tool.

Don't fit a bracket on a machine and leave its bolting surface crowning.

Don't think that what you know about a machine nobody else can find out.

Don't forget that your fingers are softer than gears, or iron of any kind.

Don't forget that the closer you can get your toolrest to the work, the better it is.

Don't make a piece of work to a blueprint and have it look like something else.

Don't forget that the warmth of your hand will increase the diameter of a shaft.

Don't mark machine part numbers bottom side up, when you are erecting a machine.

Don't build a machine with castings that have molding sand still sticking to them.

Don't drive a key into place unless you have some means of getting it out again.

Don't grind a tool to cut machinery steel the same shape as you would to cut tool steel.

Don't bore a large steam engine cylinder when lying in a horizontal position if you can possibly do it in a vertical position.

Don't carry dirty tools back to the store room, for the storekeeper to clean off.

Don't use a long-neck planer tool, when you can get at your work with a short one.

Don't serve an apprenticeship without learning to dress and temper your own tools.

Don't forget that a universal lathe chuck should be tightened at all of its screws.

Don't start up the engine without letting off the condensed steam in the cylinders.

Don't believe that lard oil is the only solution that is good to use on dies or tools in cutting threads, or wrought iron parts.

Don't boast that you can grind a cutting tool of any kind better than anybody else.

Don't say "I don't think that is right because I never saw it done that way before."

Don't put greasy fingers on cast iron either before or while taking a finishing cut.

Don't leave a shop, without leaving a clear record, so you may come back to it again.

Don't forget that the machine you are running and the space you are occupying, have to be paid for just as well as your time.

Don't file a shaft over a keyseat, in a lathe, if it is necessary to reduce the size; either take a cut with the lathe tool, or draw file it.

Don't forget, in tapping babbitt metal, lead, or any such soft stuff, to take the tap out and clean it after each full turn in.

Don't believe that a piece of work can be laid out, and drilled, planed, or milled as accurately as if it were done in the proper jig.—Machinery.

Standard Bolt & Screw Co., Limited—Power Plant.

Half a Million of Machinery in Demand

RETURNED
APR 3 - 1906
To Owner
car Book 48
page 31
W.L.

CANADA has got far beyond the day of doubt and hesitation as to its industrial future. A decade or so ago, when our confidence was less strong, a serious fire was a menace to the life of the average Canadian industry. No so to-day !

The accompanying views give an idea of the damage done by fire to two shops—the car shops of the Intercolonial Railway, at Moncton, N.B., and the implement works of Frost & Wood, Limited, Smith's Falls, Ont.

Needless to say, these works are being restored at once. In fact Frost & Wood have issued a folder entitled "Every Knock is a Boost," with illustrations of the ruins and with the promise to their friends and customers that the works will be replaced by a better, more up-to-date plant at once.

The view of the ruin of the Intercolonial shops at Moncton, N.B., shows the havoc wrought by the recent conflagration. The burned buildings covered a big area, and the loss to the Government in the destruction of the shops is placed at over $1,000,000. The heat had the effect of twisting and distorting the iron girders and trusses to the extent revealed in the illustration.

Remains of Frost & Wood Machine Shop, Recently Destroyed at Smith's Falls, Ont.

Ruin of the Intercolonial Shops at Moncton, N.B., where a Loss of $1,000,000 Occurred.

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THE NIAGARA POWER PROBLEM TO ONTARIO.

WESTERN ONTARIO'S future possible and natural pre-eminence as an industrial centre is confronted by a spectre which is fast taking on form and substance and which jeopardizes the utilization of a natural heritage. The crisis has been reached wherein prompt action is essential and drastic measures seem inevitable.

It is stated on the authority of an hydraulic engineer delegated to look into the matter that of the power now under development on the Canadian side a large part has been contracted for by United States companies. The Ontario Power Co. has authority to develop 180,000 electric horse-power, all of which with the exception of 10,000 h.p. is said to be contracted for by the New York Central and the Westinghouse Co. to be used on the New York side, the price being $12.50 per h.p. The Canadian Niagara Power Co. may use sufficient water to produce 120,000 electric h.p., all of which has already been contracted for on the United States side. The remaining company, the Electrical Development Co., is the only one controlled by Canadian capital and the only one whose power is available for Canadian industries.

The people of Ontario and throughout Canada have been all too slow to realize this situation and unless some immediate steps are taken this enormous water power, every bit of which should be utilized to build up an industrial centre in Ontario equaled by none, will be lost to this country forever. A striking example of how Canadian natural resources are used to build up American industries is shown in the case of natural gas near Welland. Twenty years ago the Ontario towns in that neighborhood had counted on using this for industrial purposes, when a group of Buffalo capitalists secured the property and exported the total output of the gas field to Buffalo, thus aiding the manufacturers on the other side of the line at the expense of our own.

It now transpires that the report of the American committee of the International Waterways Committee suggests limiting the maximum amount of water to be diverted on the American side to 23,500 cubic feet per second and on the Canadian side 36,000. This may suit that branch of the committee but should never be considered, since there is on the Canadian side ten times the power available to develop as is possible on the American side.

Another point to be brought out and upon which the Ontario Power Commission and the commission representing the municipalities have done excellent work, is the definite supplying of power to the various municipalities and its cost delivered to the different places. Toronto now pays from $35 to $125 per horse-power a year for electric power. Although the report of the commission has not been made public it is known definitely that this committee has estimated that power can be delivered in Toronto allowing for depreciation, interest, etc., for less than $15 per horse-power a year. In view of this it might well be said that no more important question than that which faces the industrial interest of Ontario has yet arisen.

Just as we are going to press word comes from Ottawa that the Federal Government will assume control over the export of electric power, and that it has laid down a policy to govern its course. Right to export would only be granted subject to revocation at short notice and the companies developing the power would be subject to such rules and regulations as the Government saw fit to impose. The Canadian industries must have first consideration, and as far as our manufacturers are concerned it matters not whether the question is under federal control or under provincial regulation as long as the proper course is taken and the wholesale export of Niagara's power for indefinite periods prevented. The regulation of rates is another matter and the work now being done by the Ontario Government in that direction is bound to bear fruit towards that end.

BOON BY ELECTRIC SMELTING.

WHEN the Government first undertook to solve the problem of electric smelting even those most deeply interested and in the best position to judge were none too sanguine of its ultimate triumph. After Dr. Haanel prepared his exhaustive report on the subject of electric smelting the Dominion Government thought that enough had been shown to at least permit of setting aside a sum of money to carry on further investigations in Canada. Even then no definite statement was made by those connected with the investigations as to its practicability, and

the leading engineering papers were sceptical as to its final success. The announcement made by Dr. Haanel at the Canadian Club of Toronto on March 12 has entirely changed the trend of opinion in this direction, as he then announced to the world the complete triumph of electric smelting of Canadian ores, thus giving out a statement the effect of which will probably have more direct bearing on the future development of Canada than any heretofore made at any time.

He intimated that as a result of the investigations carried on Canada was at the edge of a greater commercial era than had been. It meant the commercial independence of this country inasmuch as we would in future be able to smelt our own ores. It meant that the vast ore deposits in Canada, of little value as far as any methods heretofore used could demonstrate, were now a priceless boon. It meant that these could be reduced on a commercial basis and produce a high grade of iron ore; in fact it was impossible to produce anything but a high-grade ore by the electric process. It was demonstrated that charcoal was as suitable for the production of iron by this method as coke, thus making the process entirely independent of coal. It meant, moreover, that the link between our water powers and our marvellous deposits of magnetite and sulphurous ores and their production into a highly marketable product had been forged, thus enhancing the value of our limitless water powers, which were, unlike mines, not subject to strike and final exhaustion.

The above represents the culmination of the metallurgist's dream for many years past, and means that Canada will now become a factor amongst the iron producing countries of the world. In these experiments several points were proven that have never before been cleared up in the different European laboratories and electric smelting furnaces.

The Government has done its share in this work, having demonstrated the possibilities, and it now remains for the people of Canada to develop this wonderful heritage, and there is no doubt that foreign capital will be anxious to lend a helping hand.

TECHNICAL KNOWLEDGE FOR CLAY WORKERS.

REGARDING the art and the technical details of manufacture of clay products, the practical workers in this line in Canada are somewhat at sea. This was brought out in a definite manner at an interview recently accorded by Hon. Frank Oliver and Hon. Dr. Pyne, at the Parliament Buildings, Toronto, to a delegation representing the Ontario Clay Products Manufacturers Association, at which they made a strong appeal for Government aid towards technical education in the ceramic art.

This idea deserves every encouragement. The association is not a combine nor a trade union, but a technical organization with the worthy object of mutual assistance in methods of manufacture and knowledge of the products used.

A representative from the School of Mines, Kingston, accompanied the clay workers and announced that there was a building available at Queen's University appropriate for the establishment of a course in ceramics in connection with the School of Mines. The request was such a modest one, namely, three thousand dollars a year for the establishment and maintenance of this additional technical education for the benefit of a growing and already important branch of manufacture, that there is no thought of an unfavorable reply from the Ontario Government.

To reach the highest development in any art, science or process of manufacture, the world's onward progress has already proven that technical education is essential. The men composing the Ontario Clay Products Manufacturers' Association have spent thousands of dollars experimenting that might easily have been saved had such information as would be provided by the course mentioned been available. The Province of Ontario cannot afford to miss this opportunity of adding another branch to our technical education and at the same time help to build up an industry that is already important but which is bound to have a much wider application as the industry is developed.

MUNICIPALITIES AIDING INDUSTRIES.

FROM time to time the importance to municipalities of their taking up the matter in a business manner of attracting industries within their limits, has been dwelt upon in these columns. Some of the Canadian towns and cities that have grasped the situation and acted accordingly have gone ahead by leaps and bounds as a result. Mention has already been made of places aggressive along this line for some years past, and we find amongst the list the towns growing most rapidly and having the greatest air of prosperity of any in the country.

Port Arthur, Ontario, is the latest town to take this up on an extensive scale. A by-law recently passed by the ratepayers allowed for the appropriation as a factory centre of fourteen hundred acres of land suitably situated for that purpose. In doing this the people have shown considerable foresight and business ability and have set a good example, and one well worthy of emulation, to towns many times larger. In doing this a municipality is in a position to make a definite proposition to a manufacturing concern and offer any inducements that the case may demand. For example, a firm treating with Port Arthur with a view to establishing an industry there will be able to figure to a nicety the cost, besides getting free land if such is contemplated, which is infinitely more satisfactory to the firm than if they had to deal with the municipality regarding water rates, taxes, etc., and then take up the question of suitable land location with private individuals. The efficiency of this method has been demonstrated and other towns will probably wake up and follow the same course.

INFORMATION FOR FOUNDRYMEN

AT the request of a number of our subscribers we propose starting a department devoted to the interests of the foundryman and dealing with the latest foundry practice. The foundry is one of the most important departments in a manufacturing establishment, and we feel that it has not received the consideration in our columns that its importance warrants. To make this department of the greatest possible practical value and benefit we have arranged with Mr. David Reid, of the Canadian Westinghouse Co., Hamilton, who is one of the foremost authorities on foundry practice in America, that he not only contribute but also keep in close touch with it. Mr. Reid will answer questions dealing with modern methods in the foundry or difficulties met with, and our readers interested in this phase of manufacture are freely invited to make use of the opportunity thus offered.

Ontario's Problem Regarding Niagara

Hon. Adam Beck Speaks at Guelph.

SPEAKING on the question of Niagara power, and its availability to Canadian municipalities, at Guelph recently, as reported by the Guelph Mercury, Mr. Beck stated that the Canadian side of Niagara Falls could economically supply heat, light and power to 1½ millions of Ontario's population of 2¼ millions, without impairing its scenic value or its value as a great advertisement for Canada. If the Government gave help in developing water powers in the north to bring out minerals, timber, pulp-wood, and agricultural products, it was equally justified in developing Niagara power to benefit the industrial centres of the south. The value of this power depended upon its cheapness—could it be developed and delivered at a price lower than that of steam? A number of enterprising municipalities, of whom Guelph was one, had co-operated in appointing a commission and contributing $15,000 to investigate the facts bearing on this question. The Government, seeing the great change that had come about in the values and uses of electric power, had supplemented their work by a second commission, and he believed the reports these commissions would present would be of some service to the people, even if it was not within their province to indicate to the municipalities how they should co-operate in getting the power. It had been demonstrated in South Africa and California that electric power could be transmitted long distances without much loss, and there was nothing mechanically to prevent the Government conveying electricity generated by water power to every part of the province. The Minister pointed out that the present Government, on assuming power, had cried "Halt!" to the Niagara power franchise giving; they realized that there was something valuable to be conserved for the people. He was free to confess that he believed the power could be brought to Guelph and other places at a low price, but if the people wanted it, they must demand it, as governments were not likely to move out of their ordinary course without strong public pressure.

Private Company Methods.

They could not get cheap Niagara power, he might tell them, if the companies handling the electric product were over-capitalized or their stock watered. Mr. Beck's judgment was that, in private hands, the making of electricity was done by one company, the transmission of power by a second, and the distribution of it by a third, but all three were one; the only use of three companies instead of one was to provide for more watered stock and greater profits at the expense of the consumer. The speaker also pointed out that the distribution of electrical power in any municipality was a natural monopoly. It did not matter whether they gave an exclusive franchise or not, it amounted to the same thing, and Mr. Beck spoke of their efforts to hold Brantford back from concluding a bargain for power with a private company. He also seriously doubted whether the competition of the power development companies at the Falls would result in low prices; he was inclined to look for a division of territory and a uniform price; the clauses against combining were valueless. Mr. Beck detailed the experience of Montreal city with the magnificent water powers of the St. Lawrence. At $40 per horse-power, the original charge, there was a great saving to the smaller power users in the use of electrical power, but one company gradually absorbed all the plants and franchises, raised the cost to $60 and $75 per horse-power and from 8c. to 14c. per kilowatt, and were now paying 7 per cent. on a capitalization of 24 millions, when the investment was only 7 millions. And when the power users protested against paying dividends on this watered stock they were met with the cry of interference with vested rights and of doing injustice to the widow and orphan and the honest investor who had bought the stock. Manufacturing firms are now combining to establish steam in that city, and Westmount, a suburb of Montreal, was establishing its own steam lighting plant, and that was all the benefit the cheaply produced electrical energy was to Montreal, for it was known that power was brought 90 miles from Shawinigan Falls and delivered at Montreal boundary at $15 per horse power, the monopoly distributing company then taking it in hand and selling it at $50 to $150 per horse-power. The people and the council of Montreal were to blame for granting such a franchise. Mr. Beck then went into detail on the conditions under which Niagara power was being transmitted by private companies to Buffalo, and showed how these were being duplicated in the transmission of power to Toronto. The development, transmission and distributing companies were all controlled by the same group of men—Pellatt, Mackenzie, Cox, etc. Instead of electric power being distributed to Buffalo at $15 to $20, it cost $31, and the city was talking about going back to steam for lighting. Buffalo, with 2,900 arc lights, paid $75 per light. What good was Niagara Falls power to the city of Buffalo?

Toronto, formerly paying $70, now paid $65 with steam power; Hamilton, with the cheaper power of the Cataract Power Company, using the city's streets and the people's canals, paid $80; London, with steam power, paid $76 per arc light. Outside the Deering and some large outside factories, which were brought to Hamilton by the low rate of electric power quoted to them, the smaller consumer and the people of Hamilton got no advantage from it. Hamilton, with electric power, paid 10c. and 15c. per kilowatt for electric lighting; Toronto, with steam power, paid 8c. and 12c.

Different Conditions Necessary.

There was then no prospect of cheap light and power for Ontario towns and cities from Niagara Falls unless under different conditions than obtained in the cities quoted. Mr. R. J. Fleming, manager of the Toronto Street Railway Company, told the News that the cost of Niagara Falls power wholesale would be $35 and $40 per horse-power; the transmission company charged $35 to deliver it. But they must remember always that the development company, the transmission company, the distributing company, and the largest consumers were all the same people. According to Mr. Fleming's statement Niagara power would not be delivered in Toronto at a price lower than steam power. Niagara power was a great boon; yes, but not at that price. Not the cost of production, but what the people would stand, regulated the price.

Mr. Beck was dubious as to any fair arrangements between the Governments of the United States and Great Britain as to the curtailment of power development at Niagara Falls to preserve the scenery. He was afraid the Americans would have already legislated for all the power they could use, and Canada would be shut out were power development stopped. Such a policy, too, would give a strong and immensely valuable monopoly to the present holders.

$19.50 Power for Guelph.

In the power development agreements it was stipulated that Canada should have the advantage of the lowest rate at which power was sold by the development companies to United States con-

sumers, and to the extent of half their production. Under these agreements power was being sold in 30,000 h.p. lots to the New York Central at $12 per horse-power at the Falls. Ontario users were entitled to that rate. Taking $12 as a basis the commission, which had been employing experts and engineers in investigating the problem, believed electric power could be delivered at Galt sub-station at $18 per horse-power, with the cost of local distribution added. That was not the cost price, but a price at which the power could be sold at a profit. The commission had found that in Berlin there were 29 firms using 1,595 horse-power who were prepared to pay $20 to $25 per horse-power for electric power. Berlin should get this, if a reasonable rate was charged for transmission over the $12 Falls rate, at $20, while the street railway people wanted to charge Toronto $35. In the Guelph district, on the same calculation, if the city of Guelph bought 2,500 horse-power, it should not cost more than $19 or $19.50 per metred horse-power.

Mr. Beck went into some technical information as to how prices of electric power varied, showing how, by storage batteries, overlapping, a company might buy 2,500 horse-power of 24 hours and sell 3,000 to 3,500 horse power of varying hours. The chief consumption of power was between 4 p.m. and 6 p.m. in Winter, when the lights were lit before the factories were closed. The cost of power would depend in Guelph largely on the economic adjustment of power to the needs of the several utilities. If Edison was successful in using cobalt instead of nickel for a storage battery, that would insure very cheap power in distribution.

Objections to Government Transmission.

Mr. Beck discussed objections which would be raised to Government transmission, viz., that some cheaper power such as produced gas or gasoline would be put in use; that the power might be transmitted without wires, and the right of way rendered useless, etc., but he did not lay much weight upon them. The water power cost nothing for fuel, coal was likely to get dearer, and if the right of way became valueless for transmission it could be used for other purposes. They had based all their calculations on buying a private right of way, but if arrangements could be made with the railways, and he believed that was quite feasible, to use their right of way for transmission lines it would greatly reduce the cost. In all new railway charters the Government had reserved the right to allow electric transmission lines on the rights of way. The Cataract Company used the G. T. R. lines, Mr. Yule interjected.

Nothing benefited and increased consumption more than cheapness, continued the Minister. Reduced prices brought greater demand. He believed in the possibility of transmitting power to Windsor and Sarnia at a price as low as the distributing company were paying in Toronto.

Importance to Manufacturers.

Mr. Beck dwelt on the immense importance to the manufacturers of Western Ontario of cheap power. They had the energy, the thrift, the capital, the climate, the facilities for transportation of raw material; none were better able to cope with business affairs, but yet much depended on the price of power. Winnipeg was providing 100,000 horse-power at $15 per horse-power, as against the $35 to $50 per horse-power asked in Ontario. The people of Winnipeg had refused Mackenzie & Mann the privilege of bringing in power for the street railway, which they owned; the people demanded that Mackenzie & Mann buy municipal power, and the railway people had appealed to the Legislature to compel the corporation to let in their power lines. In view of Winnipeg's power advantages, it behooved Western Ontario to wake up and act at once in the preservation of cheap Niagara power.

Benefits to Public Utilities.

Hon. Mr. Beck, in conclusion, spoke of the benefit of cheap power to a city owning as many public utilities as Guelph. He quoted the profits made in 1905 by Port Arthur, viz., $10,000 on her railway, $10,000 on her lighting, and $2,000 on her telephones, because of cheap power; her taxation had been reduced from 25 to 14 mills. Municipal and Government telephones were all right, but the power question was more important. A reduction of $15 per horse-power would mean a saving of $600,000 a year to Toronto, whereas the total telephone receipts were $400,000; the telephone benefited the few, while light and power helped the many. Mr. Beck eloquently pictured some of the advantages which cheaper power would bring in the way of extension of the benefits of cheaper and better public utilities to the common people: manufacturers, too, would be enabled to pay better wages. The fault lay with the people if they did not make these things possible.

M. P. Shea, who has become widely known to the trade, first as traveling salesman and later as advertising manager of the Canadian Fairbanks Co., Limited, has received another promotion and is now in charge of the gas engine department.

PERSONAL MENTION.

The Imperial Cement Co., of Owen Sound, have appointed as their manager Mr. H. W. Wood, formerly of the Owen Sound Portland Cement Co., Shallow Lake.

H. J. Fuller, president of the Canadian Fairbanks Co., Limited, has returned from an extended western trip, during which he visited the firm's branches at Toronto, Winnipeg and Vancouver. Like everyone else who goes west, Mr. Fuller is enthusiastic over business prospects there. He states that the demand for machinery and hardware supplies is increasing very rapidly in that part of the country.

* * *

In the Van of Progress.

To meet the requirements of their increasing business, Allis-Chalmers-Bullock, Limited, of Montreal, have made a number of additions to their sales organization. Among them is Mr. T. J Lynch, who has been appointed district manager at Toronto. He is already well known there, having for two years superintended on behalf of the Allis-Chalmers Company, Milwaukee, the construction of the fifteen million gallon pumping engine for the city of Toronto. Previous to that he was connected with the Metropolitan Waterworks and Sewage Commission of Boston. Under the new management they have entered upon an aggressive policy in the pursuit of business. They have leased a suite of offices in the new Traders' Bank sky-scraper in Toronto, added to their office staffs in New Glasgow and Winnipeg, and are

* * *

Steel King Indisposed.

It is doubtful if the illness or indisposition of any man in the United States could have a similar effect in the financial, industrial and mining world as that of Charles M. Schwab, president of the Bethlehem Steel Corporation, and interested in the Tonopah and Goldfield mining districts of Nevada to the extent of $5,000,000 or more. The capital stock and bonded indebtedness of the Bethlehem Steel Corporation is $53,851,000. Therefore, upon his good health and activity rests a good deal, as he has a large following in steel, iron and gold.

When the United States Steel Corporation was formed, Charles M. Schwab became one of the wealthiest men in the country, for he was paid $32,000,000 for his holdings in the properties that were gathered into the huge steel combination. Then he went into the shipbuilding scheme and succeeded in getting about all there was in sight. Many of the properties afterward were liquidated, and from this and other things there grew the Bethlehem Steel Corporation, upon which some $12,000,000 now is being spent in improvements of all sorts.

Tricks of the Trade.

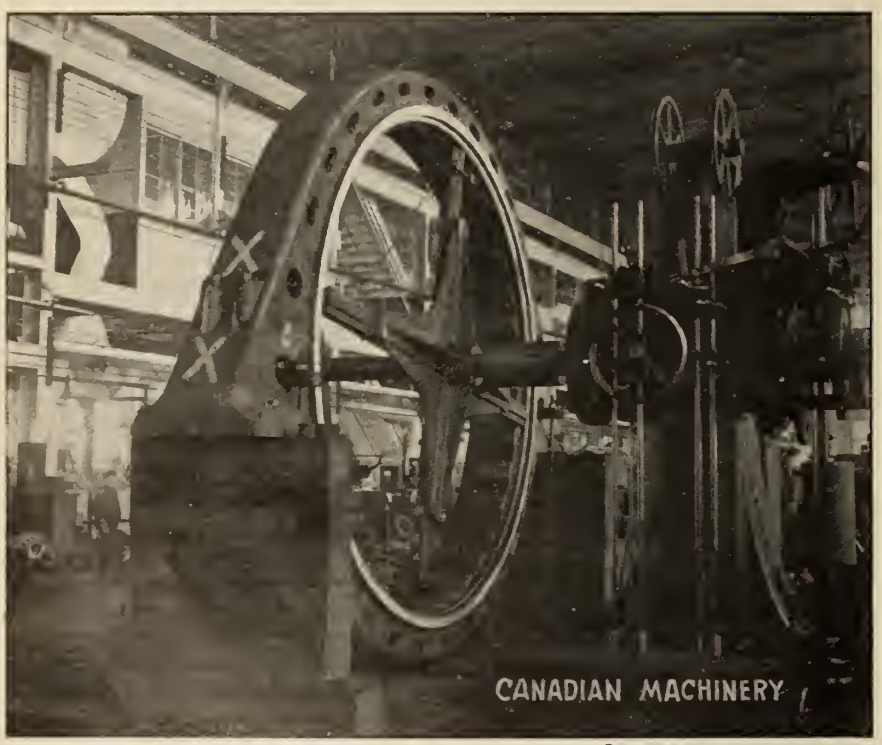
Everybody is invited to contribute to this page. Send in your ideas, odd jobs you are doing, and anything of interest to fellow-workmen. Remuneration will be made for such contributions. [Ed.]

A Boring Job on a Miller.

TO meet the exigencies so frequently met with in all lines of business very often peculiar methods are resorted to. Such was the case of a large electric manufacturing concern here in Canada who had promised the shipment of a large alternator before the proper facilities for doing the machine work on it had been installed.

The machine in mention was a 500 k.w. alternator whose inside diameter was 10 feet 8½ inches. To necessitate the machining of the frame of this machine required a very large boring mill which though ordered had not yet been installed and as the shipment within a certain date was very necessary delay was avoided by doing the work as follows: The frame of the alternator was placed in an upright position on the surface table of a rotary miller (see illustration). The spindle of the miller was raised and set in a position directly in front of the centre of the alternator and was lengthened by an additional steel spindle 6 feet long and 6 inches in diameter which extended through the centre of the alternator frame and was supported at its extreme end by an upright standard upon which was held an adjustable journal into which the end of the spindle fitted. Upon the spindle was placed a four-armed web whose arms extended close to the bore of the alternator, and upon the end of each arm was placed a compound rest which held the bariny tools. The tools were fed through and back by means of the spindle feeds, which are of a large range. By means of the compound rest they were also enabled to fall off both sides of the bore. The diameter of the alternator being far beyond the capacity of the miller some difficulty was experienced at first in reducing the speed of the cutting tools, also the time required to do the work was somewhat longer than if it had been done with the proper facilities.

G. P. J.



Heavy Job for a Milling Machine

Competent vs. Incompetent.

Quite recently I met a representative of your valuable paper and agreed if anything turned up in my experience worthy of calling attention to in particular, to make a note of same and write up a little article to that effect, as Canadian Machinery was anxious to give its thousands of readers the benefit of practical knowledge from men in actual practice. The telephone rang. "Hello! Can you come down at once? Our engineer has made us a lot of trouble." So promising to be down at once, got ready and went and looked over the cause of the trouble. The engineer had gone away and forgotten to close the gauge cocks on the water glass, and they had burst the glass and let the water run out of the boiler; the plates were badly scorched and things in general were in a bad way. Then instead of draining the pipes, he disconnected the same upstairs and water flowed over sugar barrels and what not until emptied, then he found the drain valve and shortly after liberty to hunt another job. Mentioning his experience to another engineer, he said he never shut the valves on his engine or boiler as water might get in his cylinder and "bust the end out." He meant his cylinder head, but if his practice is continued of never shutting his gauge cocks at night as he said it would wear them out on the point, he may have the same opportunity of seeking some other employment he is better acquainted with.

Another case I may mention was the crosshead pin had sheared the pin which keeps it from revolving through the engineer having the brasses so tight, and coming up to me in the course of a few days after this occurred he told me he discovered the pin was going round and on investigating same found it had, necessitating the boring out of the crosshead and a new pin. "Now," said my unlearned friend, "the engine runs away and all I done was tighten up the strap." I may explain it was a ball flywheel type of governor and the combined strength of two men could not move the balls which ought to fly away from centre and cut off steam as the speed increased beyond its regular gait or recede to give more steam as the engine slackens from a heavy load being applied. Releasing the strap I said, "Open her up and let her go." The man in charge did so—I am not at liberty to call him the engineer—and after letting the engine gain her speed I told him to get me a plank until I applied a pressure on the fly wheel. "Oh, no," he said, "I daren't leave her; she'll run away," so after assuring him of no immediate danger, and that I would hold her with the plank, he secured one twice as long as necessary, and everything has been all right since. Now it seems if there is an inspector about he never puts any of the so-called engineer through a course of sprouts to find out if he is running the engine or the engine running him, so the danger of putting such men in charge of steam plants is evident enough without further elaborating. These events have all happened in the course of a few months and the men engaged were raw recruits. The facts herein contained may be verified any time and the cost to the firms mentioned approximated $300 for these oversights by unskilled, incompetent men in charge, and on an average would pay for qualified men. WITNESS.

Mechanical Reviews

OPINIONS AND STUDIES WORTH NOTING

SHOP TOOLS AND DEVICES.

FOR rectifying work which has been threaded with a solid die and which has as a result a thread not true with the body, as exaggerated at (A) Fig. 1, I use a piece (B) in a spring chuck in a bench lathe, or other lathe, and hold the piece by the thread while turning and facing (as indicated by the dotted lines) to true the job with the screw. I carry pieces like (B) for screws in common use, for various purposes as I have shown in other articles. The thread and outside run true, and the lock-screw (C) bearing on (A) with a point, holds the screw by the sides of the threads, a centre being obtained also if needed.

A method of coiling heavy spring wire on a light arbor is illustrated in Fig. 2. The piece (D) is held in a chuck or collet in the tail stock of the lathe, and drawn back as the spring is coiled, thus supporting the arbor (E) at the bend of the wire. I recently wound in this way piano-wire springs of the dimensions given on the sketch.

Fig. 3 shows how a pair of milling cutters can shave down the sides of a thin tapering piece, such as a watch regulator, by being made to work against each other, and give a draw cut. The teeth as shown at (F) being on a tangent, strike the work gradually and two or three at once. (G) shows the manner of clamping the work. ...

Figs. 4 and 5 are old-time devices for rocker filing such pieces as are shown in these two sketches and in Fig. 6. Flat filing is easily done in this way.

The holder in Fig. 7 is for turning flat work like (H), say a counter bore or reamer blade. The only novelty in the device is the slot (I), sawed in from the end, which obviates the difficulty of filing out a slot for the blade, the nut (K) making a solid job. By slotting two pieces like (H) in the centre half way across, and interlocking them, they can be inserted in right angle slots where the size of the arbor will admit, and so form a four-lip reamer, or a tap all fluted.

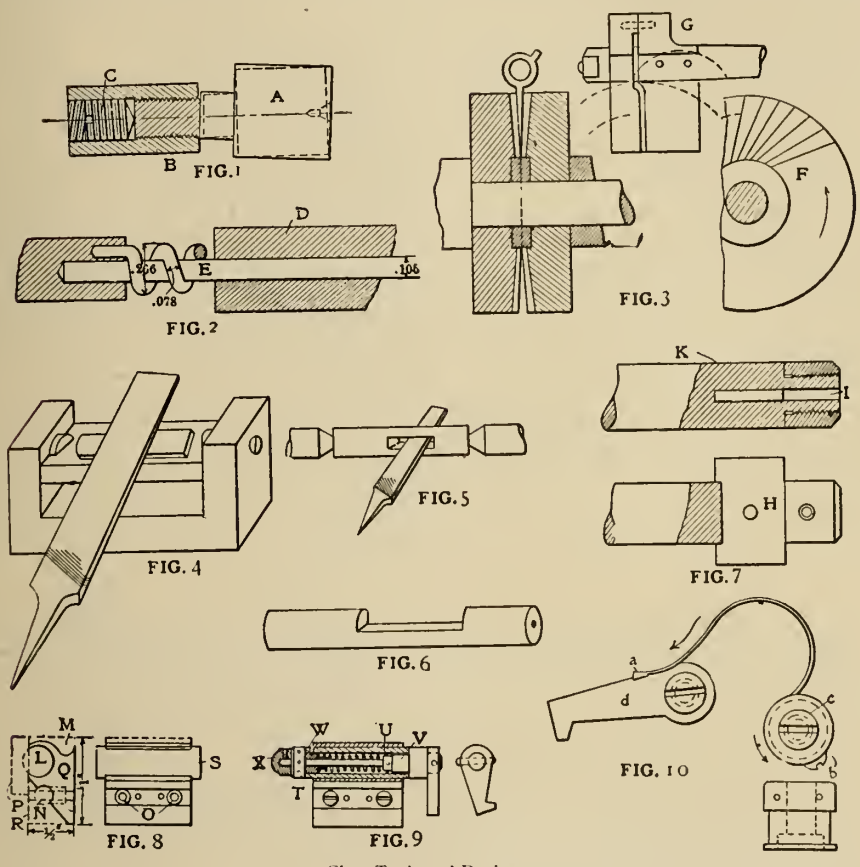
By the way, a tap can be cut readily in a lathe, and cut without tearing, by cutting it somewhere near size first, then milling the flutes, annealing the steel, and cutting the thread to size last. This helps in the hardening, too, as it takes the warp out of the steel.

Figs. 8 and 9 cover several points of interest. The first illustrates how a very neat pawl-bracket was made in a bench lathe and mostly with twist drills. The material was mild steel 1x½ inch, sawed off in the power hack saw. The holes (L,M,N,O,O). were drilled, as shown by dotted lines. The extension (P) was clamped to (Q) to facilitate drilling (L). The corner (R) was sawed off by hand. The sleeve (S) was soldered into (L) and a file completed the piece. Fig. 9 shows the pawl mechanism, which is lively and has a great range of adjustment. The spiral spring is soldered at the ends to collars (T) and (U), the latter locking the arbor for the pawl at (V). By turning (T) by the pinholes to get the tension on the spring, and locking it with the screw (W), entering depressions in (T), the pawl is given any pressure needed (X) is merely a retaining collar.

In Fig. 10 is shown another adjustable pawl spring, a flat one with edges turned down at (a) to keep it in place. By turning the stud (b) and securing it with the screw (c), the spring is moved in the direction shown by the arrow to increase the tension. The spring as constructed is almost unbreakable.

This pawl was used in an index with eight divisions. It carried the index plate two places, then a retaining pawl held the index while the pawl (d) moved back a notch. Then the retaining pawl came out and the pawl (b) drew the index back one space; thus the pawl moved two spaces each time and still gave eight divisions. The spring as arranged was easily adjusted to give the pawl the right pressure on the index to draw it back while overcoming the friction of a thin cup-spring against it.

Some of this matter may come in handy in model and experimental work or in machine construction.—American Machinist.

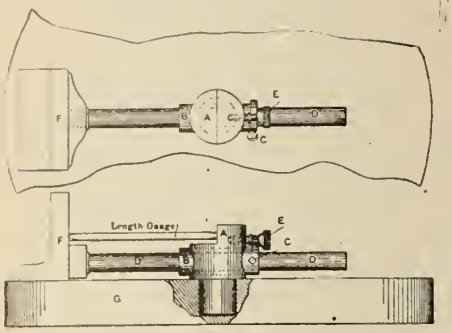


Shop Tools and Devices.

WORK SETTING TOOL FOR LATHE AND BORING MILLS.

THE cuts show the device and its use in setting up the angle plate, (F), and the same method of use applies when chucking a piece of work off centre. The central pin, (A), which

fits the centre of the table is bored at right angles to receive the sleeve, (B). This sleeve is provided with a setscrew, (C), and a lug on the upper side for the milled head adjusting screw, (E),



Work Setting Tool for Lathe and Boring Mill

The rod (D) is fitted in (B) and one side is flattened for the setscrew, (C). In use the adjustment is first obtained by sliding the rod (D) to its approximate location, where it is locked by the setscrew, the final adjustment being gotten by the adjusting screw, (E). The lower sketch also shows how a length gauge may be used in connection with the device, a shoulder being provided on the upper end of (A) whose face passes through the centre of the table. It is, of course, necessary that the shank of the device fit the boring table hole closely.—Mechanical World.

HOW TO BALANCE PULLEYS.

IT is surprising to note how an otherwise capable mechanic goes about the seemingly simple process of balancing pulleys and other revolving parts. I saw a first-class machinist place an 8-foot section of line shafting, which had several pulleys on it, be-

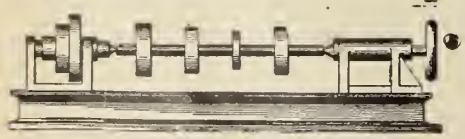


FIG. 1.—WRONG WAY.

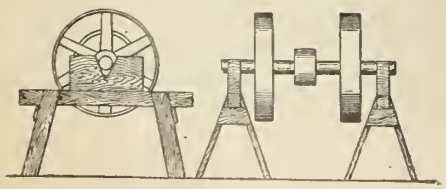


FIG. 2.—ANOTHER WRONG WAY.

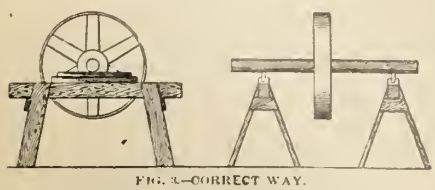


FIG. 3.—CORRECT WAY.

How to Balance Pulleys.

tween centres in a lathe, to balance it, after the manner shown in Fig. 1. Of course he failed, and the job had to be done by somebody else.

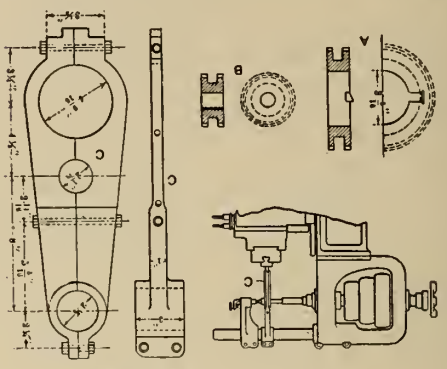
Another machinist, who ranked very high, did something even more incongruous. A countershaft with three pulleys on it, was brought into the shop to be balanced. The man got two V-shaped blocks, set them level and dropped the ends of the shaft into the grooves, as shown in Fig. 2. The foreman ordered the shaft removed from the V-blocks, but the man did not take any of the pulleys off the shaft, but tried to balance them all together, so the work had to be done over by another workman.

Every engineer would do well to have in his tool box two steel straightedges, about 15x1¼x¼ inches. These can be let into wood and placed on blocks or horses which have been leveled especially for balancing work, as shown in Fig. 3. Only one pulley should be put on the shaft at a time, as it is impossible to balance more than one pulley at once.

Balancing a very wide pulley, or a drum, presents a very difficult problem, and it is hard to find which end is out of balance. I have seen drums 3 feet long run in loose bearings very rapidly, while chalk was held to the shaft to mark the side which was thrown out of true by centrifugal force. The heaviest part of the rim being shown in this manner, weights were added to the opposite side to effect a balance. Theoretically, when a revolving body is in balance, every part is balanced. That is, if any number of sections were cut through it at right angles to the centre, or line of revolution, no matter how closely together, each section should balance. Of course, this condition is almost impossible in practice.—J. P. H., in Power.

TOOL FOR TURNING WRIST PINS AND TUMBLING SHAFTS.

AN interesting special tool for turning wrist-pins, tumbling shafts, etc., is the design of Mr. John Tonge, master mechanic and master car builder of the Minneapolis & St. Paul Railroad at Minneapolis, Minn. It is used on the milling machine or lathe according to the class of work. The wrist-pins of four bar guide crossheads are turned on the milling machine with this device, as shown in the accompanying cut. Of course on a job like a crosshead or any other job having shoulders which prevent sufficient overtravel of the tool, the tool must be set twice in order to finish the surface. The device consists of a frame, (C), split on its centre line in two parts, which are solidly secured as one when in operation, by bolts at the centre and ends. The smaller end of the frame is secured to the arm of the milling machine, and the centre hole is brought in line with the machine arbor which passes through it, and the pinion, (B), is splined to the arbor. This pinion meshes into a gear, (A), which is made in halves and fits

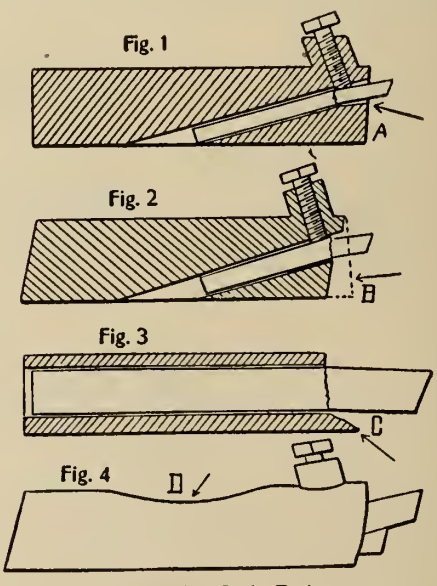


Milling Machine Attachment.

the larger hole in the frame. Both of these gears are grooved to fit the frame in which they work and cannot therefore leave their respective positions. The larger gear has an internal diameter large enough to clear the largest wrist-pin, and is fitted with a cutter by which the turning is done. The motion imparted to the pinion by the arbor is communicated to the gear which in turn drives the tool. When used on the lathe for turning tumbling shaft bearings a gear is screwed on the spindle in place of the faceplate and this meshes in a pinion mounted on a short splined shaft which drives the pinion (B) in the same manner as the spindle of the milling machine.—Railway Master Mechanic.

READY-MADE LATHE TOOL.

OLD mechanics looking back over their history as such can remember the days before the patent lathe tools. In those days they were



Ready-Made Lathe Tool.

obliged to forge their own tools into the desired shape. Modern improved tools can be ground to any desired shape and used in most any position.

Their use, however, requires a certain amount of judgment.

Fig. 1 shows the effects on a small tool used for too heavy duty. This tool was made for a 12 or 15-in. lathe, but was used in a 30-in. lathe. The bottom at (A) is worn away until the pressure of the screw breaks the steel.

Fig. 2 shows the effect of grinding without removing the steel. The under support is completely ground away at (B). Fig. 3 shows a cutting-off tool allowed to hog in and break, battering down the support, (C). Fig. 4 shows the effect on a small tool which was used in a large lathe. The powerful screw mashed the tool at (D).

I recently looked over a number of patent tools of different makes. They had been used about one year and were a sad looking pile of junk. A lack of good judgment had sent them to the scrap heap.—Popular Mechanics.

JACKS FOR PUMP PIPES.

IN Fig. 1 is shown a jack and its parts in detail for holding pipe. The jack may be made of either $1\frac{3}{4}$ in. by $\frac{1}{2}$ in. steel, very good iron tire or of $1\frac{1}{8}$ in. square axle stubs taken from an old carriage axle.

The hook or claw which holds the pipe is shown at (A), and a side view of it, showing the manner of forging so as to strengthen it at (H), where a hole is drilled to receive a $\frac{5}{8}$ or $\frac{3}{4}$ in. rivet, is shown at (C). This claw is made for $1\frac{1}{4}$-in. pump pipe, the size most commonly used. The lever and rest is shown at (B). It should be curved in the arm so that when in use the hook cannot touch the platform to loosen the hold on the pipe. (D) shows a top view of (B). The hole (I), in the lever, (B), is for receiving a chain or rope when using the tool over an old-fashioned well or cistern, and prevents the tool from falling in and being lost. The rivet holding the parts together should be strong and fit like that in a pair of tongs. The tool opens and closes by lifting away from (E).

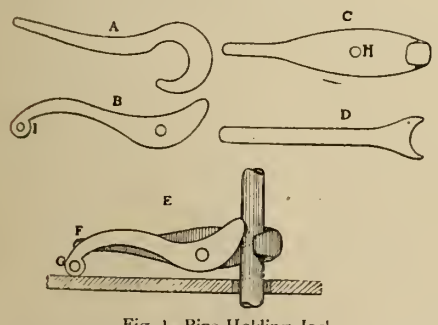


Fig. 1—Pipe Holding Jack.

For lifting and lowering pump pipes a tool like the one shown at (X) is satisfactory. It may be used either with a rope or by passing a bar or hand spike through the ring, so that two men can lift on it. It is made of $1\frac{1}{8}$-in. axle stub of square stock, the opening being just large enough to let the pipe into the hole of the tool which should be but $\frac{1}{8}$ in. larger than the pipe. This tool is shown in use at Z.

A tool for hand use is shown at (Y), and it may be used singly or in pairs. The ring at the end provides hand-hold and it is turned out of the handle solid, just like a poker hand-hold. The light part should be $\frac{3}{4}$ or $\frac{7}{8}$ in. round and the rest of $1\frac{1}{8}$ in. square. A set of these tools should comprise a jack as at (E), rope and a lift like (X), or a jack and two hand lifts like (Y).—American Blacksmith.

STARTING A GAS ENGINE.

THIS is the question that comes up many times in the mind of the young engineer, when he finds out after a number of fruitless efforts to "get her started," that she will not turn her wheels or "go." Now there is a reason for this condition of affairs

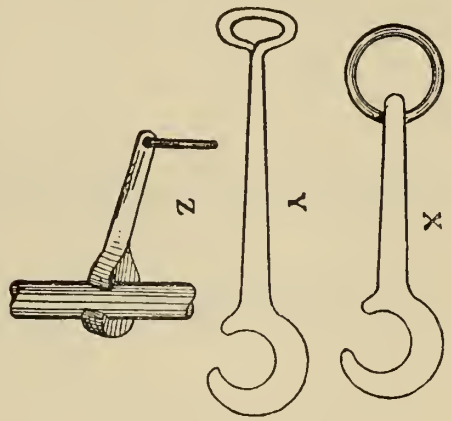
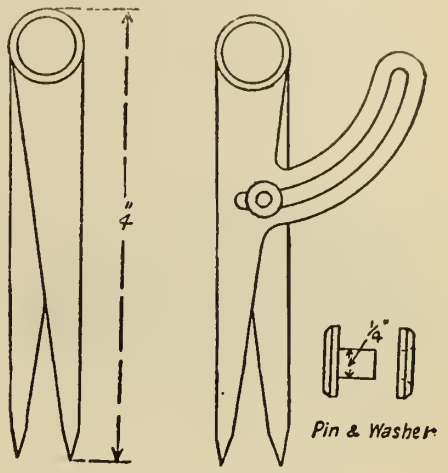


Fig. 2—Pipe Lifting Jack.

when the gas engine refuses to obey the behest of the driver, and I propose in this article to give such plain instructions that the novice may be assisted in starting the gasoline engine. In the first place see that the compression is right, that the admission valve is tight and will admit only enough of the mixture (gasoline and air) to make a charge that will take fire from the sparker and move the piston forward. In the next place see that the sparker is clean and will make a bright spark at white heat when the contact is broken, and at the right time. And right here I want to say to you what "in time" means to go if everything else is right, and "out of time" means to not go even if everything else is all right. The valves of the engine must be kept well ground down with emery and oil so as to preclude a possible leak, for this will very seriously weaken the power of the engine even after it is started. The spark must be made when the connecting rod of the engine is on the "up stroke," with the crank-shaft about three inches below the horizontal line of the centre of the cylinder, and herein lies the whole secret of the greatest efficiency from the least amount of gasoline. As there is an interval of time after the spark is made until it ignites the charge, it is very evident that the movement of the machinery continues and the moment of ignition should take place when the compression is greatest, and this will be when the piston is on its farthest "in stroke," i.e., in perfect line with the centre of the cylinder. But if the charge be ignited at this point the engine will not develop the greatest power, as the interval spoken of will elapse and the piston will have started on its "out stroke," thereby not getting its full force of the expansive gases, liberated by combustion of the air and gasoline.

Therefore, it will readily be seen that we must allow for the interval spoken of if we would get full returns for the energy we use in propelling the motor. I have tried to make this plain and very easy to understand, and I hope my efforts will help out some experienced or inexperienced gasoline engineer, who has trouble with his engine, either in starting or developing the power at which it is rated.—The Gas Engine.



Compasses for Metal Work.

COMPASSES FOR METAL WORK.

THE compass shown at Fig. 1 can be made by most any one out of sheet material. The compass has no locking device, as it depends on the tightness of the point to keep it in position when in use. Use thicker material than is used for calipers, says the Model Engineer, London, and harden and temper the points. Fig. 2 shows another useful form of compass which is not difficult to make.

Milling Cutters; How They are Made, Used and Abused.

By John Edgar.

CUTTERS form a very important item in modern milling practice. Much of the success attained with the milling machine is dependent on them. Cutters, to give satisfactory results must be particularly suited to the work they are to perform. They must be properly designed and be made of only the best of material. None but poor results may be expected when not skillfully handled.

Fig. 1.

It is the purpose in this series to show the different styles, how they are made, how they may be used to the best advantage and how they are commonly abused.

Milling cutters may be divided into three great classes., the first of these being the plain cutters, sometimes called surface, axial or slab milling cutters. The latter term being applied to designate the cutters used on the heavy planer type machines.

The second class are those known as face mills, which may be again subdivided into two sub-classes as: side mills and end mills.

The third class comprises cutters which are made to mill a form such as gear-cutters, tap and reamer cutters, etc. They are made in two styles, those which are made with milled teeth as an ordinary plain cutter called "form mills," and those whose teeth are formed in a special forming machine, and whose shape is retained throughout their life are called "formed cutters."

The dividing line between any two classes may be straddled by any single cutter, so that it is hard to decide which class it really belongs to.

For the benefit of those whose knowledge of milling machines and their accessories is limited, it is the intention in introducing the half-tone, Fig. 1, to familiarize them as much as possible with the different styles before going further into the real object of the articles.

The cutters shown in group (a) are the simplest cutters used on a milling machine. These are plain milling cutters. When this style cutter exceeds three-quarters or one inch in length, they are made with spiral teeth, that is, the cutting edges are given a twist. It is claimed that this reduces the power necessary to pull the cut, they are less liable to chatter and will therefore produce a much better surface. These cutters are then called "plain spiral mills," examples of which are shown at (b).

When a large amount of stock is to be removed, that is, when the depth of cut is great, the teeth are made much coarser and are "nicked," giving a cutting edge, which is not continuous across the face of the cutter, but is divided up into a number of short cutting lengths, each separated by a nick, the nicks on one tooth being staggered to those on the preceding and following (c). This style cutter will remove a given amount of stock with the least possible expenditure of power and much faster feeds may be used than with the plain mills.

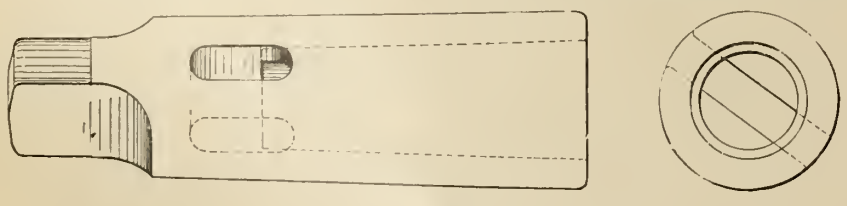


Fig 2.

Another form of plain mill is that shown at (d). Those are called metal slitting saws, and vary in thickness from one-sixteenth to a quarter inch, and in diameter from two and a half inches to twenty inches, and larger. Saws thinner than one-sixteenth inch are called screw slotting saws and are generally made to correspond to some sheet metal gauge number in thickness.

The cutter shown at (e) is a side milling cutter belonging to the second class tooth, as will be seen in the example at mentioned above. As will be seen, this cutter has teeth cut on its sides as well as on the periphery. It is made to be used on a shank to which it is keyed and held in place by a nut screwed on the end of the shank. This style cutter is more properly called a face mill. To the rear of this cutter is seen a large inserted tooth face mill. In this case the cutter is large enough in diameter to permit of a large hole to fit on the threaded end of the machine spindle, and is therefore provided with a threaded hole. The body of the cutter is made of cast iron and the blades of cast steel. When particularly hard service is required of this style cutter it is better to use some good quality of self-hardening, high speed tool steel for the teeth, as they will wear longer and require less sharpening and will permit of much higher speeds and faster feeds than the ordinary grade tool steels.

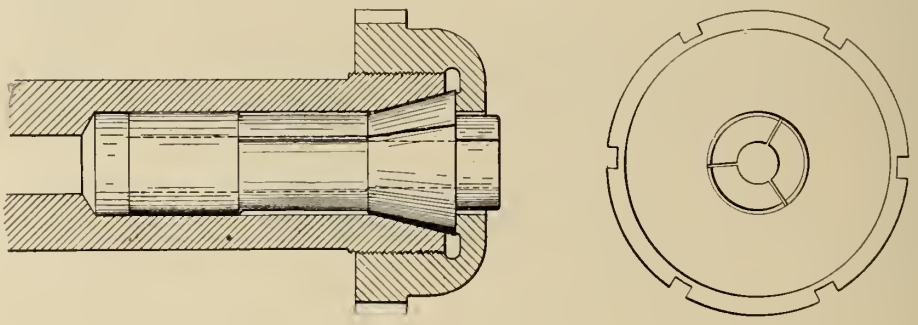


Fig. 3.

Sometimes it is desired to finish both sides and bottom of a deep groove with a milling cutter. One method of doing this would be to use a side milling cutter with teeth cut on both sides and periphery. Such a cutter is shown to the left of the large face mill.

Another method of finishing the groove

would be to use an end mill, in which case the centre line of the spindle would coincide with the centre line of the groove and be perpendicular to the bottom of same. Four end mills are shown to the rear of the group (a).

These end mills have straight shanks spotted so that they may be held in a simple collet and secured in place by means of a set-screw. For many purposes it would be best to have the shanks made to some standard taper, such as the Morse or Brown & Sharpe. The latter is the recognized standard among milling machine manufacturers. The taper need not necessarily be as large as that of the hole in the spindle, but is generally made to correspond to the size of the mill itself. In use this mill is inserted in a reducing collet, the outside of which is made to fit the spindle and the inside to fit the shank of the mill. Such a collet is illustrated in Fig. 2.

When the mills become so small in diameter that it is no longer practical to make them with taper shanks, they are made with straight shanks, and in such cases are usually held in a spring collet, the most familiar form being like that shown in Fig. 3. This collet consists of three parts, the body or shank, the split bushing and the ring. The bushing is provided with a hole to fit the shank of the mill, a separate bushing being necessary for each size shank. The outside of the bushing is made with a conical head, which fits into a conical seat in the shank, and, being split, contracts on being forced home by the threaded ring, thus binding on the shank of the mill, keeping it from turning or working loose. This is the most successful method of holding straight shank mills, as it holds them sufficiently tight for most purposes and will always run true if properly made.

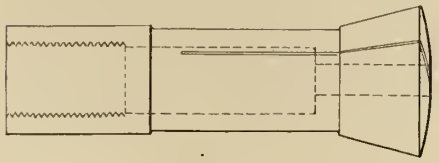


Fig. 4.

The Becker-Brainard Milling Machine Co. have incorporated this idea in the smaller sizes of their vertical machines by making the spindle of the machine with a conical opening. They use it as the body part of the arrangement mentioned above and provide a collet like Fig. 4, that corresponds to the bushing above, which is drawn back into the taper by a draw-bar, making a very simple and handy method for holding the small end mills which are used so extensively in these machines.

Going back to the half-tone, we will find at the extreme left in the foreground, examples of a special form of side milling cutter. These are angular milling cutters such as are used in making cutters.

On the right we have cutters which will be recognized as belonging to the third class. The cutter shown at (f) being a "form mill," since the shape must be followed in sharpening, while that at (g) may be sharpened by simply grinding the face of the tooth, is called a "formed cutter."

We will next treat the matter of selecting the proper style cutter for different work and give some points that may help in the design of same.

The design of milling cutters must depend to a certain extent on the purpose for which they are to be used, but we may give a few rules which will apply to most cases and be useful in all cases, though they may require a certain modification in their application.

In making cutters, much depends on the facilities at hand for milling and hardening same. A cutter might be made a certain way to a great advantage, but would be very difficult to harden, so that modifications, while they show a loss of efficiency, must be made in order to be successful.

Designing a Wood-Working Molder

By T. C. Robertson.

ARTICLE III.

Arrangement of Feed Rolls.

ARRANGING feed rolls and cutterheads forms an important feature in molder design as regards convenience of operation coupled with rigid construction. The accompanying sketch (Fig. 1) shows a recent construction of feed rolls which will be appreciated by mill men. The rolls in table are so arranged as to be interchangeable with top rolls, which are usually corrugated. It often occurs that moldings have to be made of dressed lumber that is already scant in thickness, and if the operator desire to finish face side up and a light cut is to be taken off, the corrugated rolls might mark the material too deep to be taken out. To avoid any trouble in this direction they may be placed in table and smooth rolls put on top. These rolls when placed in position should be slightly inclined so as to lead material being fed to hug tightly against fence in passing through. They should also be carefully adjusted in relation to top of table, for if too

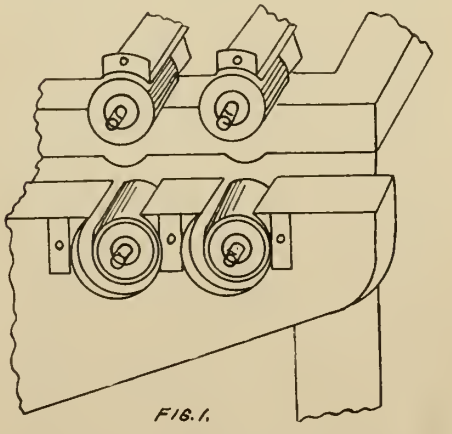


FIG. 1.

high it will cause wavy work owing to material not resting firmly on table.

While we have under consideration the location of feed rolls it might not be out of place to suggest what might be considered an improvement by some on what is known as outside molders, that is to provide in construction of machine a delivery or feeding out roll which for ordinary matching would prove a great convenience, besides adding very much to feeding power of machine. It might be possible to so arrange these rolls that they could be removed if in the way of doing certain kinds of work.

Position of Cutter Head.

The bottom cutter head may be placed either before or after top cutter head, or one on either side, according to design of molder. Both positions have strong advocates from operators and both have their peculiar advantages according to method of finish adopted. In any case provision must be made for using long knives, causing a throat piece to be placed in table which must be made adjustable to and form

head so as to act as a chip breaker for any diameter of cut. This requires to be done quickly and firmly, and if possible to leave the table in as smooth condition as necessary. The usual method of doing this has been to fasten with screws from top countersunk below table, leaving an uneven surface. By referring to sketch (Fig. 3) a method is shown by which throat is clamped firmly and quickly in any position by means of a cam and lever connection, leaving a smooth and even table which is appreciated by operators desiring to do fine work.

By referring to sketch (Fig. 2) a method is shown by which bottom cutter head is drawn out from its position in table, allowing freedom in setting and sharpening knives, also a slide by which the head and its connections may be adjusted vertically. When bottom cutter head is placed after top head provision should be made to swing projecting part of table out, exposing cutter head for convenience in adjusting and sharpening knives.

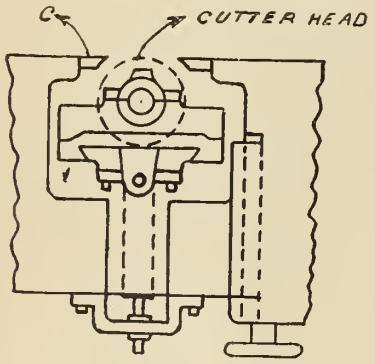


FIG. 2.

The top cutter head should be mounted upon a heavy shaft contained in a yoke which should be adjusted horizontally and provided with a removable outside bearing, which is necessary in removing head. A new feature in driving this head consists in double belting one pulley in centre of yoke and one on outside. To the writer this additional belt seems necessary only when a large amount of stock requires to be removed and should be avoided if possible, owing to space occupied. A better construction might be larger pulleys and double belt on inside of yoke carrying the head.

Other Features.

The shoe or chip breaker in connection with top head should be so pivoted as to swing as near as possible in line with circle of cutter head and have adjustment to and from head for different lengths of knives. It should also have detachable piece giving further adjustment and permit of applying special shoe pieces. A feature on this detachable piece which has recently been introduced is to provide steel sections of different widths which are made interchangable in case of uneven wear, the steel also insuring a longer period of wear than cast iron. The entire shoe is weighted and is so arranged that it can be easily pushed back out of the way.

The pressure bars in connection with side heads when bottom head cuts first can be so designed as to act with much greater efficiency than when bottom head cuts last. Room is obtained to have horizontal as well as vertical adjustment. Pieces of any shape can be applied and located in any position upon bar within the limit of cut of heads. These pressure bars can be so designed as to throw entirely out of way to facilitate adjustments on side heads.

These notes upon molder design have been but fragmentary, the aim being to call attention to some of the recent developments which have a bearing upon those interested in their operation and construction. It is a fallacy to suppose that the builders of these machines originate the valuable improvements which from time to time are developed. They are indebted to the operators of these machines, who are in a position to find out the weak points and make suggestions for improvements. In fact in all lines of machine development the designer is indebted to the operator for his most valuable contributions which come to him in such a way that credit is not always placed where it belongs. These notes upon molder design apply to what is known as outside molders. The inside molder is adapted to a more limited class of work more closely allied to standard planing and matching machines.

LIFE SAVING DEVICES OF A MODERN FACTORY.

By J. G. L.

In very few lines of manufacturing are the possibilities for accidents so great as in a plant turning out tinware in large quantities. Some years ago, in the largest manufactories of this kind, the day which passed without a serious accident was almost phenomenal.

Recent advances in mechanical science, however, have wrought such a revolution that these are now comparatively infrequent, and not so serious as formerly.

A special study of this problem of reducing accidents has led the Thos. Davidson Manufacturing Co. to adopt some very considerable precautions in their large plant at Montreal. The entire plant is kept scrupulously clean. All employes are expected to eat their lunch in the club rooms, where tea, coffee and milk may be obtained at the moderate charge of two cents per cup, and during the noon hour the entire factory is aired and ventilated so as to be in a sanitary condition for the rest of the day.

The club rooms referred to are maintained by the Employes' Benefit Society in connection with the company, which enjoys a membership of over one thousand people. The society employes a doctor to treat all members who are ill, and also provides for "sick pay" in the case of employes who have been with the firm six months or more.

In a convenient corner of the factory is a small surgery where the easier cases are treated. A better equipped surgery is located in the club and here the more serious injuries are attended to. The majority of such are treated by a medical attendant who is a member of the staff, but, where amputation is necessary a surgeon is called in, or the patient sent to the hospital.

The ponderous presses which make the innumerable fittings required for all the products of such a plant, are responsible for most of the accidents,

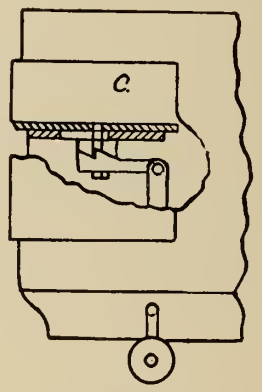


FIG. 3

though there are occasional cases of severe burns, in the tinning and galvanizing rooms. Up to a comparatively short time ago, the most dangerous machine in the factory was that which cut the centres from screw tops intended for gem jars. This was done by putting the tops in singly, so that the operators frequently lost fingers in placing or removing the article. Now, however, a rotary centering machine is used, and injuries are rendered impossible. The operator places the tops in holders fitted to a revolving disc, and when the holder reaches a certain place, the press descends and cuts out the centres.

In connection with the operation of turning out the gem tops, two other machines are utilized, which are of great interest because they replace older machines entailing great danger in handling.

The visitor to this plant cannot fail to be impressed with the precautions taken everywhere in protection of employes. Indeed, it is considered to be a model one in this respect.

Foundry Facings

The Trade in General.

BECAUSE the foundryman labors and sweats, toils amid sand and dust, gas and smoke, and emerges therefrom sooty and grimy and soiled, indicating clearly that he is not on the road to a five o'clock tea party, and, moreover, because popular opinion regarding him as a factor in manufacture has been at fault, the shaper of molten metal has not been conceded the position due him in view of his importance in the industrial world. The manufacturing costs of many lines have their start in the foundry and every manufacturer knows, who has a foundry in connection with his plant, that to economies effected here in recent years is due in some measure the lessened cost of production.

While the art of molding antedates most trades by centuries, the foundryman has until recently shared but few of the working comforts that modern progress has adapted to other artisans. Any old corner was considered good enough for the foundry, and the constitutions of the workers therein were supposed to be proof against what would put an ordinary mortal out of business in a few weeks. This condition of affairs was accepted as a natural inheritance and little complaint made. A man naturally partakes to some extent of his surroundings, and in the dark and gloomy atmosphere that was recently characteristic of many molding shops it was but human nature asserting itself to find the men lacking somewhat in ambition to probe deeply into the science of their trade.

A change for the better is manifesting itself on all sides. Foundries that once were dim and dismal are now bright and attractive. Labor-saving devices of all kinds have been introduced, making the trade less one of drudgery. The effect is evident in the men themselves. They are brighter, more cheerful, more active, more intelligent, and more anxious to learn. This does not infer that the men have not been intelligent or anxious to learn, but that with a change of conditions a sense of individual broadening and expansion has been experienced.

It is hoped that this is but the beginning of a much higher awakening among the foundrymen, and that not one of them will be content until he has at least gained a fundamental knowledge of chemistry and metallurgy, in doing which he will find an added interest in his work and make his services of more value not only to himself but to the firm with which he is engaged.

Top of the Trade.

SEEMINGLY few of those engaged at the foundry trade have realized the possibilities ahead of them, and which need but a certain definite application and ambition to make the possessor of that trade one of the most indispensable factors in the industrial world. The average foundryman has never realized that to become a metallurgist is his natural field, and having a theoretical knowledge that enables him to analyze his materials places him on an altogether different footing being more capable of understanding the different actions and reactions and of knowing definitely, without the shadow of a doubt, the exact requirements of the case. One of the few who have upheld the standard in this direction is

David Reid, Hamilton
President Associated Foundry Foremen of America.

Mr. David Reid, of the Canadian Westinghouse Co., Hamilton, Canada, president of the Associated Foundry Foremen of America.

Mr. Reid is a Scotchman, having been born in Glasgow, coming to America with his parents and settling in Worcester, Mass. He took a special high school course with a view to becoming a civil engineer. This idea was dropped, however, and Mr. Reid entered the foundry instead. About a year after this, on returning from work one day, grimy from the result of honest labor, he met a former high school teacher who lamented that the young molder had taken such a step, and intimated that he was throwing his life away. He realized, however, what has already been mentioned, that there was lots of room for a man who wished to know the why and the wherefore or the causes and different effects in connection with this, one of the oldest of the mechanical arts.

At the end of three years he went to Connecticut to get an insight into tool machinery, afterwards returning to the Holyoke Machinery Co. as leading hand on their heavy work, aiding the foreman in getting up the rigging for all classes of work, and putting in a great many hours experimenting and studying in his own time without extra pay. Later an opening occurred in the Builders' Iron Foundry, Providence, R.I., in the gun room, and here he spent about five years on heavy engine and Government work. The foreman in this works selected him as a specialist to start the heavy work in a new foundry of Howard & Bullough Co., of Pawtucket, where, after about two years of strenuous work, his health broke down and he was ordered home to Scotland.

Even when on pleasure bent he found time to put in some practical work in the Old Country, particularly marine work, and in Dundee was offered the position of foreman, which was refused to return to the United States. On returning Mr. Reid became a leading hand in the Corliss Engine Works, Providence, R.I., and from there to the foremanship of Saco & Ritter, later becoming manager. By introducing modern methods here, such as molding machines, and dividing the labor, whereby the molder practiced the art of molding and nothing else, the melt was increased from 12 or 15 tons daily to between 50 and 60 tons.

Not being satisfied with his knowledge of metals at this time, Mr. Reid arranged for a course in chemistry and metallurgy with the Boston Testing Laboratory, under Prof. Saveur, of Harvard. The determination of the man is shown from the fact that for nearly a year he left at 2.40 a.m. on Saturday, traveled 100 miles to Boston and worked all day in the laboratory, after which a couple of hours' rest and he worked till midnight. On Sunday he started at 7 a.m., taking a lunch with him and remained there until 5, after which he took the train, arriving home at 10 p.m. To get closer to the iron industry he resigned his position to accept the superintendency of the Howard & Bullough's American Machine Co. A flattering offer from the Rarig Engineering Co., Columbus, Ohio, took him to

this place, where he was engaged principally in Government work. From there he became associated with the Westinghouse Co., which led up to his present position of superintendent of the foundry department in the Canadian Westinghouse Co.

Besides the above mentioned practical experience, Mr. Reid is a member of the American Society for Testing Materials and a member of the committee for two years on getting up standard specifications for castings and cast iron, as well as a member of the American Foundrymen's Association and the Associated Foundry Foremen. Mr. Reid has risen to his present position as one of the most prominent foundrymen of America through well-directed, intelligent effort and proper realization of the possibilities. He is an authority on many branches of the foundryman's art. Many of the readers of Canadian Machinery will be glad to know that arrangements have been made with Mr. Reid whereby he will contribute practical articles on foundry practice from time to time, and will answer any questions dealing with foundry practice that may be sent in to this office.

A Foundry Kink.

I came across a little kink in the foundry the other day. A hand wheel was brought in. A broken-down job I thought; it looked like it. The rim, hub and four pieces of the arms were there. The hub was broken in two, but that did not matter as much as the loss of the arms. It was a hand wheel, of the same style that is used on the tail stock of a lathe. The hub was about 4 in. above the rim. To put in six arms all the same without the pattern was the problem. The wheel was about 18 in. in diameter, so the workman got a 24 in. flask, put down the bottom board with the parts of the wheel on it, and bedded it in. Then he made the joint of the three arms on one side of the flask. There was a centre bar in the flask that came down near the joint. This one side of the flask was rammed up, lifted off, the pattern drawn and turned around with the arms on the other side of the flask. The hub was turned, too, as that gave a better guide to go by, and the joint was made the same as the other side. The cope was put back and rammed up, lifted off and finished. I would state in connection with this that if a molder is making a job where there is a vacant space outside the bar, before the flask is lifted off it is a good idea to take the trowel and cut square down along the bar on the outside. Then if other things are right he will get a clean fit. —T. W. in Browning's Magazine.

Practical Questions and Answers

Bearing Metals.

Ques.—What are the chief constituents of bearing metals and wherein are they more suitable for bearing surfaces than other metals?

Ans.—The chief essentials of a bearing metal are:

1. That it be strong enough to carry the load without distortion.
2. That its coefficient of friction with the metal which bears on it be small.
3. That it be easily molded or formed into the required shape.
4. That the bearing metal be soft enough so that any wear that takes place will be on the bearing metal and not on the journal.

The numerous alloys used as bearing metals have properties which fit, to a greater or less degree, these conditions. When backed by a casting they are strong enough for ordinary loads, some of course, being more suitable for heavy work than others.

The numerous experiments that have been conducted by bearing-metal manufacturers have resulted in very frictionless metals, although the coefficient of friction between two surfaces depends far more upon the efficiency of the lubrication than upon the composition of the bearing metal. The best systems of lubrication provide that a thin film of the lubricant completely separate two bearing surfaces.

The last two conditions are, of course, fulfilled by bearing-metal alloys.

There are practically as many different alloy compositions as there are brands of bearing metals on the market, some of them being very much alike while others are widely different. The chief constituents of bearing-metal alloys are, however, copper, tin, lead, zinc, antimony and iron. There are very few bearing-metal alloys which do not contain copper, and it forms the largest per cent. composition by far in most of them.

White metal is one of those containing no copper. Lead is contained in nearly all, forming a very large percent composition in some and small in others. Most of the metals also contain tin, mostly in small quantities, although there is one metal made up of 98 per cent. tin. Antimony is contained in many, but there are only traces of iron in any of them.

Copper Tubing by Electroytic Process.

Ques.—What is the electrolytic process of making copper tubing?

Ans.—The process is as follows:

A wooden core is turned up the size of the core of the pipe. This wooden core is coated with plumbago to form a conducting surface. In a bath of copper sulphate, acidulated with sulphuric acid, this is made the cathode, while a mass of partially refined copper is made the anode. A current of electricity being passed through the solution copper is transported from the copper cathode to the core of wood forming the anode. To ensure that the copper will be deposited evenly over the surface the wooden core is rotated in trunnions through which electrical connections are made, and a carriage, similar to a lathe carriage, on which is mounted a tool tipped with agate, traverses the length of the core, the tool pressing the copper down as it is deposited, the carriage being automatically reversed at each end.

The proper current density (about 10 amperes per square foot) being used the foreign metals in the copper anode fall to the bottom of the tank and can afterwards be recovered.

This process is the Elmore process. It is a successful process, practically, although there have been some commercial failures, but according to some authorities these failures were due to improper financing. The advantage of it over the drawn copper tubing method is that almost pure copper seamless tubing can be made, while it is practically impossible to draw copper tubing without causing oxidization, thus decreasing the strength. One of the practical disadvantages of the Elmore process is the difficulty met with in getting bends in the tubes.

What Determines Temper?

Ques.—What is it in the steel that determines its temper?

Ans.—The temper of a piece of steel is determined by the amount of carbon it contains. The higher the per cent. of carbon the higher is the temper. When steel is used for such tools as cold chisels, drifts, etc., the usual amount of carbon is one per cent. The amount of carbon in lathe tools, milling cutters, taps, drills, reamers, etc., varies from one to one-and-one-half per cent. according to the temper, which of a necessity varies according to the hardness of the work.

Machine Shop Costs

By G. C. Keith.

Paying System.

ON pay day, which should be a few days after the pay time ends to allow the time-keeper to make up his pay roll and the cashier to get the money counted and put in the envelopes, the men line up according to their numbers, presenting receipts for their pay and receiving their envelopes. This receipt is made out by one of the clerks, from the pay roll. They are distributed to the men before the hour of payment. The following is a good form of receipt :

"Note.—If this amount is not correct notify your foreman immediately. You must present this receipt or you will not be paid."

Another system of paying which is

$\$$ ..... CHECK No. .....

Received from ENGINE COMPANY LTD. the above sum for the half month ending.....

Date..... Full Name.....

NOTE,——

convenient, but not so commendable, is to carry around the envelopes, giving each man his pay on presentation of his receipt.

Rates of Employes.

To arrange the rates so that no time will be lost copying them into the shop statement and labor slips is an easy matter. Plain white cards 2 in. x 3 in. are arranged according to numbers in a small box. Thus :

101 21½

M. Rennie

It is then easy for a clerk to go through the box and write out the rates on his pay roll and other lists. When the time-keeper gets an order from a foreman for an increase the rate may easily be changed without destroying the card.

Employe's Record.

In every cost office should be found a record of all the employes, past and present. Two files should be kept and the time-keeper should keep the cost clerk informed of any changes, such as new men arriving and old employes leaving, increases, etc. If a man leaves the works the reasons should be at once written on his card, which should

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

NAME _____ CHECK No. _____

ADRESS _____ DATE _____

WHERE LAST EMPLOYED _____

AT WHAT WORK _____

WHY LEFT _____

REFERENCE _____

AGE _____ MARRIED _____ HABITS _____

DATE EMPLOYED _____ DATE LEAVING _____ REASONS _____

WAGES PER HR. _____ DEPARTMENT _____

WAGES							
	INCREASED	TO—PER HR.	TO—PER HR.	TO—PER HR.	TO—PER HR.	TO—PER HR.	
	DECREASED	TO—PER HR.	TO—PER HR.	TO—PER HR.	TO—PER HR.	TO—PER HR.	

REMARKS _____

then be placed in the file of past employes. A card about 4 in. x 6 in. should be used for the purpose.

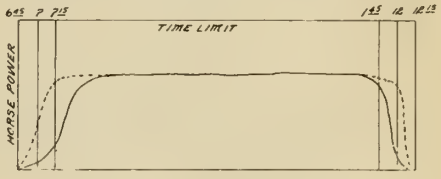
Fixing Prices or Time Limit.

To find the price or time-limit for a certain pattern several things must be taken into consideration—the setting up of the piece of machinery, handling, changing to perform a different operation, etc. Suppose we wish to arrive at the time-limit for shaping the base of a small engine 18 in. x 30 in. The long edge is placed at right angles to the tool. Two cuts are taken, a rough and a finishing cut. By timing we find that the shaper takes 15 strokes per minute, and by measurement with a rule it feeds 1-16 in. per stroke. The total width being 30 in., 480 strokes are necessary and take 32 minutes. A finishing cut will take 32 minutes more, making in all 64 minutes actual time. In ordinary work 20 to 25 per cent. is allowed for setting up, sharpening tools and margins, but this percentage varies with the nature of the work. The time allowed, therefore, would be an hour and ten minutes, but it will be found convenient to make a rule to take the nearest quarter hour. The time-limit will then be one and one-quarter hour. Supposing a man to be earning 14c. per hour on the shaper, the price for him would be 17c. each.

A Mechanical Check.

Probably one drawback to the premium or time-limit system is that some time a point is reached where the workman is afraid to produce more in fear of being "cut." Even in the case where a man is supposed to watch premium workers it is impossible to find out who is being paid too much for his work. Men have been known to dull their drills to keep from doing too much work. The only way to detect this is by an ordinary engine test, which must be carried on every quarter hour from seven to eight, eleven to twelve, one to two and five to six. From eight to eleven the horse-power used will be found to be about equal throughout. If the men are doing their work the horse-power used by the engine will be constant.

If the men are doing their work we get the dotted line. One factory dis-



covered their loss in this manner and the result was a cut in their piece-work prices. The output was increased 11 per cent. and the men still make as much as before, but they work a full day for it.

A lesson from the diagram which we should learn is to have the employes at the works on time and start their work on time. Men coming in late, men starting their work late, absentees and men leaving before the engine stops running means loss of power, a leak in the profits which should be stopped at once.

NAME Engine Base OPERATION Shaping

CONTRACT	PATTERN	TIME LIMIT	PRICE	ACTUAL TIME	REMARKS
612	A 9	1¾ hrs ea.			Two cuts
613	A 16	2½ " "			Two cuts
614	A 12	1¼ " "			Two cuts 18"x30"

Electric Smelting Assured

WHEN Dr. Haanel, Dominion Superintendent of Mines, who has been investigating the problem of electric smelting at Sault Ste Marie for the Dominion Government, gave his first public detailed announcement as to the complete success of the method at the Canadian Club, Toronto, on March 12, he made a statement that will have a powerful influence on the future of Canada, practically assuring its commercial independence of all other countries. He said it was now proven that the vast deposits of iron ore in Canada, hitherto considered valueless because of their high sulphur contents, may be profitably utilized by the use of the water power with which Ontario and Quebec are so richly blessed, this meaning that Canada can undertake for itself the steel and iron industry, the basic industry of modern civilization, without having to import coal or ore for that purpose. Using entirely Canadian products, Canadian manufacturers will be able to make the tools and agricultural implements for the settlers pouring into the country, will be able to build the bridges and boats and railways which are to open up our vast territories, and make the machinery to be used in thousands of busy factories.

RETURNED MAR 19 1906

Commerce Founded on Iron and Steel.

"The iron and steel industries," Dr. Haanel said, "are the foundation of our modern civilization. To realize our dependence upon them, try to imagine what the state of affairs would be if our iron and steel industries were swept away. Transportation by railway and by boat as we have it to-day would cease, the machinery in our factories would be banished, and the comforts and luxuries of our life destroyed. We might better do without gold or silver than this much cheaper metal."

The commercial status of a nation, he continued, depended largely upon the development of the iron and steel industries. Not speaking of England, which was the pioneer in this work, Germany and the United States to a great extent owed their prestige to the development of their iron and steel industries.

The country which required to import its iron ore was handicapped in the race for commercial supremacy. In the fiscal year of 1903 and 1904 Canada had imported pig iron to the value of $43,000,000. Thus was Canada dependent on other nations for a material necessary in every industry.

In Canada, which was the Eldorado attracting a teeming population, the need for iron was increasing to provide tools and agricultural implements for the new settlers, structural material for railways, boats and bridges, and material for the modification of established and the inauguration of industries. To stimulate and encourage production of iron and steel from abundant raw material the Government had given generous bounties and imposed import duties.

The distribution of the raw material in Canada was peculiar. While the necessary coking coals for blast furnaces were found at the extreme east and west in Ontario, Quebec, Saskatchewan and Alberta were large ore deposits, but not coal deposits capable of furnishing coke for metallurgical purposes. If these deposits were to be used by processes of production at present in use, coke would

Dr. Haanel,
Dominion Superintendent of Mines.

have to be brought to blast furnaces erected in the vicinity of the mine or the ore transported to blast furnaces near the basis of the coke supply. The heavy transportation costs made the process uneconomical.

Deeply impressed with the disability under which the country rested in regard to the upbuilding of a steel industry, on entering his present position Dr. Haanel set himself to finding some other method or some other source of energy than the combustion of carbon in blast furnaces. Unless a new method could be proven to be practicable, immense ore deposits must remain undeveloped and regions remain waste which might otherwise teem with a vast industrial population.

The Electric Process.

The electric process had been profitably employed in different parts of Europe, especially in France. In the solution of the problem of applying electric energy to the extraction of metals from their ores, Captain Slassani in Italy and Herault and Keller in France had rendered conspicuous service. It was seen that if by the electric process pig iron could be economically produced, such countries as Brazil, Chili, Sweden, Norway, Finland, and Canada, all rich in iron ore deposits and possessing extensive water power, but lacking coal, would be able to render themselves independent of outside sources by employing the electro-themic process of manufactures of their iron and steel. From examination of processes in Europe, Mr. Harbord, the metallurgist of the commission appointed to investigate the matter by Hon. Mr. Fielding, decided as the probable output of 1,000 electric horse days 7.82 tons.

For the successful introduction of electric smelting of Canadian ores the following points which could not be settled by the European experiments required demonstration :

Could magnetite, which is our chief ore and which to some extent is a conductor of electricity, be successfully smelted ?

Could iron ores with considerable sulphur contents be made into pig iron of marketable composition ?

Could charcoal, which can be made from mill refuse and other available sources of wood useless for other purposes, be substituted for coke, which must be imported ?

And, lastly, what was the exact amount of electric energy required per ton of pig iron produced ?

Various Iron Ores Smelted.

To properly investigate these problems a sum was set aside by the Government and the work undertaken by Dr. Heroult of La Praz, France.

The Lake Superior Power Company of Sault Ste. Marie offered a building in which to erect the plant, and the use of one of their alternators of 300 electric horse-power capacity, free of expense for four months. The offer was accepted.

The experimentation on Canadian ores began in earnest the middle of February, the furnace being in operation night and day, with some intermissions, until March 5. During that time about 150 casts were made, yielding about 55 tons of pig iron. For the first experiments the ores employed were hematite, such as used by the Algoma Steel Company in their blast furnaces ; for the remainder of the experiments different classes of Canadian magnetite from the different sources of supply, all of high sulphur

content, with the exception of the Wilbur magnetite, which was low in sulphur, were employed.

The Furnace Described.

Dr. Haanel used a tumbler to describe the furnace. In it the ore was placed and into the midst of it a large electrode inserted. The electric current came from this electrode and through the metal to the bottom of the furnace, where it was carried off by another wire. The heat caused by the resistance offered to the current by the metal produces the heat which completes the smelting process.

Even the first experiments with magnetite showed that our fears had been groundless and that magnetite could be smelted with as much facility as hematite and with an output equal to that of the best experiment made with hematite.

"Moreover, since it was important to substitute, if possible, charcoal, which can be cheaply produced in Canada, for coke, which is dear, must be imported, the changes were made with charcoal. No difficulty was experienced whatsoever, the furnace working quietly and regularly, requiring little attention to the regulation of the electrodes.

"Analysis of the iron produced soon proved that, although the slag was not particularly basic, the sulphur could be caused to pass into the slag, resulting in a pig iron containing a few thousandths of one per cent. of sulphur.

Output Greater Than Expected.

"In every instance the output was far greater, in several instances one-third greater, than the figures adopted by Mr. Harbord, in the report of the Commission on Electric Smelting."

Experiments with roasted and briquetted nickeliferous pyrrhotite, containing 1.6 per cent. of sulphur, were equally successful, furnishing a ferro-nickel iron pig containing 4½ per cent. of nickel, and virtually free from sulphur. The estimated value of this product was $40 to $44 a ton. So successful have these experiments proven that the Lake Superior Power Corporation have decided to acquire the Government plant for the purpose of converting their stock of briquetted ore into marketable, ferro-nickel pig.

One of the most important points in the investigation, which could not be successfully settled by the experiments at Livet, was the consumption of the electrodes, and it was found that the consumption was beyond expectation small, and that an electrode which had been in use for three weeks, and during that time had been exposed to free air in an incandescent state for many hours, and had been used for melting down charges, which is always attended by waste of electrode without corresponding output in metal, that even with this severe test the consumption per ton of pig iron produced was between 15 and 20 pounds. According to Mr. Herault's estimates, this means an outlay of 30 cents per ton of pig iron.

Poor Ore Made Valuable.

"Many of our magnetites are too high in sulphur to be handled by the blast furnaces, and consequently have so far been of no commercial value. But the very best of pig iron, as has been proven, can be made from ores which contain as high as one per cent. of sulphur. A blast furnace will not usually handle an ore which contains one-tenth of one per cent. of sulphur and requires therefore an ore which cannot be got at a low figure. The Algoma Steel Works pay, I understand, $4.50 for the hematite ore which they use in their blast furnaces. A pig iron equal in value and lower in sulphur content can be made by the electric process from sulphurous ores which could be bought for $1.25.

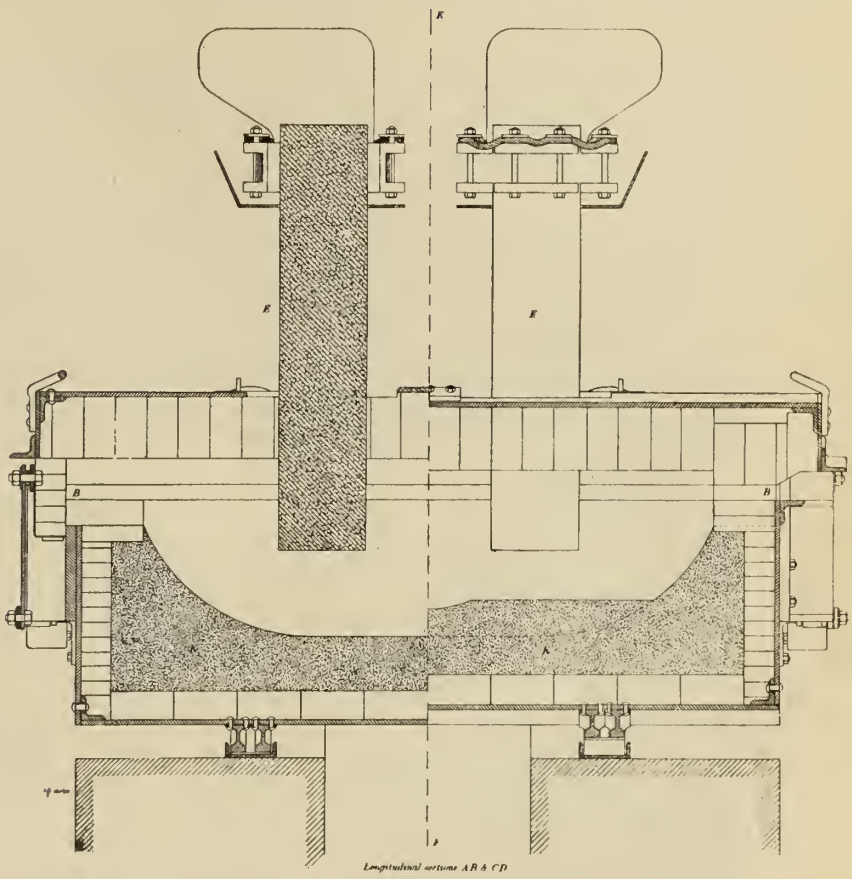
"Regarding water power required for the application of this process, it may be stated that many water powers exist in Ontario surrounded by iron ore fields in localities ill adapted for the application of electric energy for any other purpose, and could be developed to furnish an electric horse-power a year from $4.50 to $6.

"With such a price for the energy required, the small consumption of electrode, the cheapness of ore employed, and the peculiar excellence of the pig iron produced, electric smelting of iron ores in Canada, using charcoal or peat coke, made from our peat bogs of enormous extent, may be pronounced a commercial success. Under the prevailing conditions in Canada it now only remains for the engineer to design a plant on a commercial scale, say of 100 to 150 tons daily output, with all the necessary labor-saving appliances.

Blast Furnace Outclassed.

"Just as in the case of the blast furnaces, so likewise with the electric furnace, experience gained will result in further economy, and the day may not be far distant when the carbon monoxide, which is of high calorific value, and which at present, as a product of the reaction taking place in the electric furnace, is allowed to escape without utilization, will be employed for increasing the output by at least a third or half. If that should take place the blast furnace could not compete with the electric furnace even under the conditions where coke might be cheaper than at present quoted in Ontario and Quebec.

"A further advantage of the electric process is that the units employed are comparatively small and cheap of construction. A unit of 1,500 h.p. is perhaps the largest that under present circumstances should be constructed. Such



Cross Section of Heroult's Furnace, front view

a unit would have an output of about 18 tons per day and corresponds in size to about the larger Swedish charcoal blast furnace. With the present advance which has been made in the transference of electric energy, batteries of electric furnaces could be set up at various iron ore deposits which could be fed with electric energy from some centrally located water power, thus affecting a saving of the transportation costs of the ore from the mine to the furnace.

"When a deposit is worked out the furnaces may be moved to the next deposit, simply lengthening the wires which carry the high tension current to the transformer of the plant."

The utilization of ores of high sulphur content which cannot be used in blast furnaces is of especial importance, because the question has arisen, how long the present supply of blast furnace iron ores is likely to last, and when these ores are exhausted and none but sulphurous ores and titaniferous ores are available, the stacks of numerous blast furnaces will be silent and smokeless, having been supplanted by the electric furnace, which can successfully heat an ore which blast furnaces cannot handle.

Results of Experiments.

The following is a summary of the results of the experiments which have been completed under Government auspices at Sault Ste. Marie:

1. Canadian ores chiefly magnetite can be economically smelted by the electro-thermic process.

2. Ores of high sulphur content can be made into pig iron containing only a few thousandths of sulphur.

3. The silicon content can be varied as required for the class of pig to be produced.

4. Charcoal which can be cheaply produced from mill refuse or wood, which could not otherwise be utilized, and peat coke made from peat, of which there are abundant deposits in Ontario and Quebec, can be substituted for coke without being briquetted with the ore.

5. A ferro-nickel pig can be produced practically free from sulphur and of fine quality from roasted nickel ferrors pyroholite.

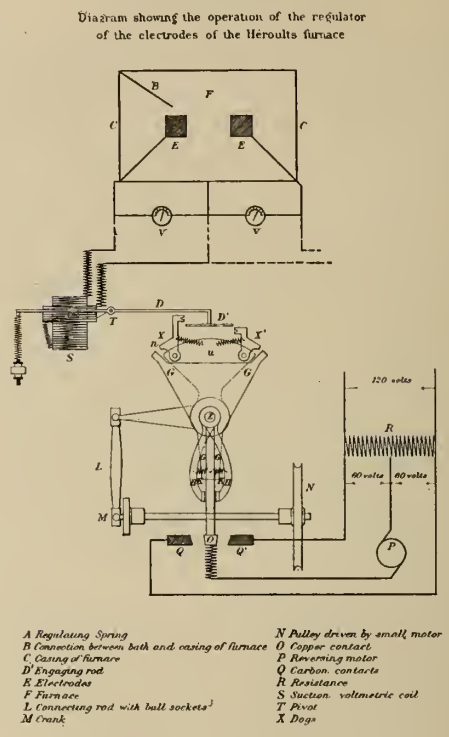
6. Pyrite cinders, resulting from the roasting of pyrite in the manufacture of sulphuric acid, and which at present constitute a waste product, can be smelted into pig iron by the electric process.

7. Titaniferous iron ores containing up to 5 per cent. can be successfully heated by the electro-thermic process.

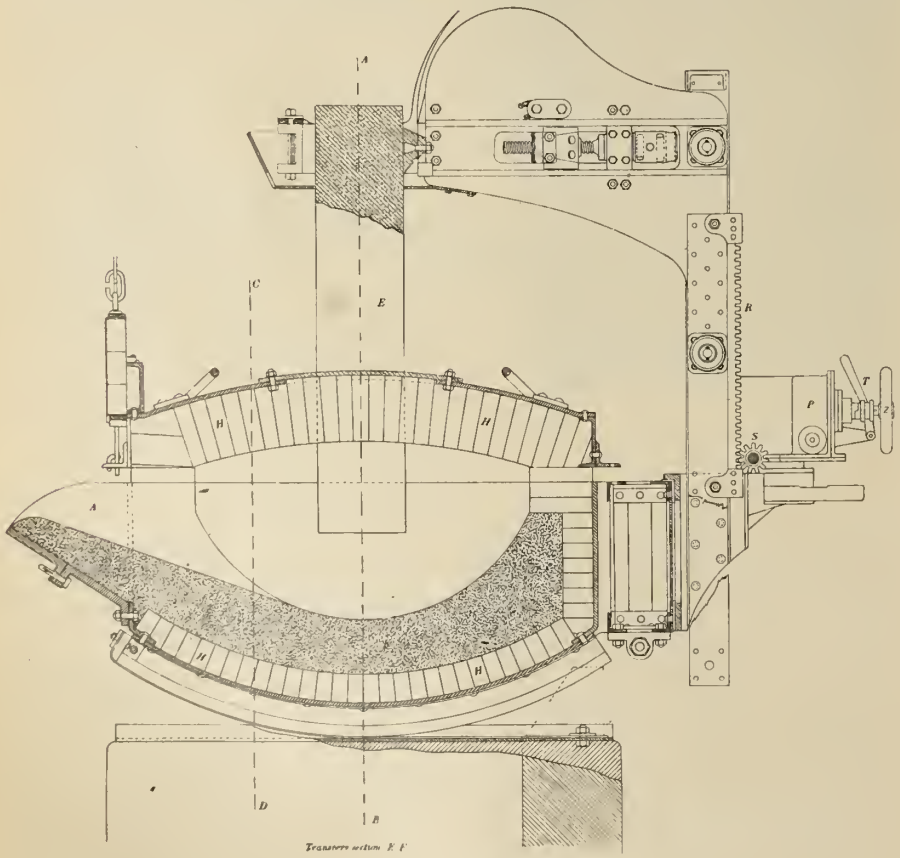
The result of the introduction of electric smelting into Canada may be summarized as follows:

(1) The utilization of our extensive water power, which cannot at present be profitably employed for any other purpose.

(2) The utilization of the large number of iron ore deposits, which, on account of their high sulphur content, cannot be treated by a blast furnace, and have so far been valueless.



Method of Operating Heroult's Furnace.



Cross Section of Heroult's Furnace, side view

(3) The utilization of our extensive peat bogs for the production of peat coke to be used as reducing material for the operation of electric furnaces, and the utilization of mill refuse and sawdust, for which there has been so far no practical use.

(4) Rendering Canada independent of fuel import for metallurgical processes.

(5) Enabling Canada to produce her own pig iron from her abundant sources for home consumption, and consequently retaining in our own country the money which otherwise would have to be sent abroad to purchase pig iron in the crude and manufactured state.

(6) The development of steel plants and rolling mills using only electric energy.

Associated with Dr. Haanel in his work was Dr. Heroult, one of the leading electro metallurgists of the continent, whose system was adopted in carrying out the experiments. Some details of the Heroult furnace, as operated in France, and its method of regulation, are given.

Heroult Process.

The furnace is of the tilting pattern. It consists of an iron casing lined with dolomite brick (HH) and magnesite brick around the openings. The hearth is formed of crushed dolomite (K) rammed on top of the dolomite brick lining of the bottom of the iron casing. Two electrodes (EE) pass through the roof of the furnace, which, in the Kort-

fors furnace were water jacketed for a short distance above and below their passage through the iron casing of the roof. The current passes from one electrode through the narrow air gap left between the electrodes and the slag line, into and through the slag to the molten metal, along it, through the slag and second air gap, to the other electrode. An alternating current of 4,000 amperes and 110 volts was delivered to the electrodes. The intensity of the current passing through the bath is regulated by adjusting the width of the air gap between the electrodes and the slag line. This adjustment is effected either by hand or automatically by a specially constructed regulator. In the former case the motor (P) is thrown out of action by lever (T). (Z,) operating on pinion (S,) which engages the teeth of rod (R,) is rotated right and left handed to lower or raise the electrodes. Diagram (Fig. 3) illustrates the principle of the action of the automatic regulator.

In Fig. 3 (B) is an iron wire connecting the bath of metal with the iron casing (C) of the furnace. The current due to the difference of potential between the metallic bath and the electrode (E) passes through the voltmetric suction coil (S,) the movable outer coil of which operating the rod (D) pivoted at (T,) and regulated by spring (A,) imparts motion to the horizontal staff (D) in a vertical plane, with every variation of difference of potential in the circuit. (N,) a pulley driven by a small motor, operating by means of the crank (M) and the connecting rod (L,) oscillates the part (U,) which is pivoted at (Z). The dogs (XX) attached to (U) partake of the oscillation of (U,) but in their backward and forward motion fail to clutch the staff (D) as long as the variation of voltage in the circuit does not exceed 2 volts ; when this limit is exceeded either way (D) rises sufficiently high, or is depressed sufficiently low, to be clutched by either (X) or (X'). When this occurs the projection of the respective dog is brought into contact with the respective side of the triangular plate (GG,) to which the prongs (HH,) pivoted at (Z,) are attached by springs (KK). This results in bringing the copper piece (O,) the suspending rod of which is also pivoted at (Z,) into contact with the respective carbon block (Q.) From the diagram it will be seen that the direction of the rotation of the motor (P,) which raises or lowers the electrodes (EE,) depends upon the contact made by (O) with either (Q) or (Q',) and hence upon the rise or fall of the voltage in the circuit beyond the limit of 2 volts.

"Not how much, but how often, is the way to handle your advertising proposition."

LES CHATS FALLS.

LES CHATS FALLS, of which an illustration is given, is one of the many promising water power possibilities of the Ottawa River, and offers one of the best hydraulic development propositions available. It was stated very recently by an expert that electrical energy could be exploited here and delivered to the bus-bars at a cost of from $4.50 to $6. The significance of this is realized when it is remembered that in some cities in Canada manufacturers are paying anywhere from $40 to $70 a horse-power per year for electrical energy, and that it costs from $30 to $40 a horse-power per year to develop power by steam in small units.

Les Chats Falls—On the Ottawa

This picturesque fall is situated thirty-three miles from the city of Ottawa, and here the total volume of the Ottawa River passes, dropping about sixty-five feet, and offering for the use of man thousands and thousands of horse power of available energy. In this neighborhood there are large quanties of iron ore. Now that the connecting link between a water power and the reduction of iron through the agency of electricity seems assured several Pittsburgs should arise in Northern Ontario, the centres of enormous wealth with none of the smoke and soot and grimy disadvantages that have heretofore been characteristic of large industrial centres.

Power and Transmission

Steam Gas Electricity Compressed Air Water

SMART-TURNER CENTRIFUGAL PUMP.

THE accompanying cut illustrates a side suction centrifugal pump as built by the Smart-Turner Machine Co., Limited, Hamilton, Ont. It is designed so that by loosening a few bolts the pump shell may be revolved on the hood of the frame, which enables the discharge to be taken off at any desired angle. The runner or piston of the pump is of the hollow arm pattern, which is the design on which the frame of the Heald & Sisco pump is mainly based. The construction is such that there are no dead spaces and the water is not thrashed by the arms, but is forced steadily toward the discharge.

It will stand very much more wear than the ordinary arm piston without allowing the water to slip back into the suction. These pumps are also designed for direct connection either to gasoline engines or electric motors.

RETURNED
APR - 9 1906
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cut Book 48
page 41
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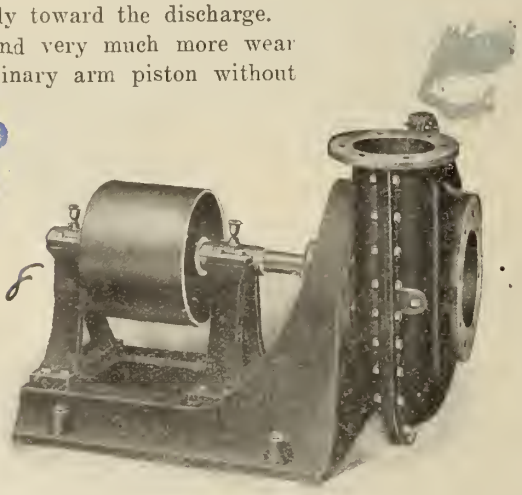

Smart-Turner Centrifugal Pump.

A PRACTICAL ELECTRIC HOIST.

THE illustration shows a two-ton Yale & Towne electrical hoist, which consists of a motor, controller and hoisting gear balanced on a single top hook, so that the centre of gravity does not change with or without load. The suspension is all taken on the hooks and two steel frame plates, so that no cast iron is in tension. The top and bottom hooks swivel, and are equipped with ball bearings. The single top hook also admits of a flexible connection between hoist and trolley or other overhead support, to prevent side strains when the hoist is lifting out of a true vertical line. This top hook facilitates using the hoist on short erecting jobs, or enables it to be attached permanently to an eye-bolt or overhead trolley. Installation involves simply hanging the hoist and connecting two wires.

All machines are thoroughly tested for defects in material and workmanship before leaving the factory. The insulation must stand a breakdown test of 2,200 volts, alternating from a transformer of adequate size. All parts are made to gauge, thus securing complete interchangeability. The gearing, motor, controller, and other vital parts are easily accessible, facilitating adjustment or renewal of parts without completely dismantling the hoist, or requiring it to be sent back to the factory. The rugged simplicity of the hoist enables its use in the hands of inexperienced workmen. No skilled electrician or operator is required.

The hoist is regularly built in 1, 2, 4 and 6-ton sizes; others to order. The height of lift is governed by the winding capacity of the drums, and is 45 feet as a maximum for the 2-ton size.

The efficiency has been developed to a very high point. The cost for lifting per foot ton is $.000303, figuring the cost of current at 10c. per kilowatt hour. On this basis one cent's worth of current will lift a 1-ton load 5 feet high six times, or a total of 30 feet; ten cents' worth of current will lift a 1-ton load 5 feet high 60 times, which is equal to lifting a ton 300 feet. The economy of such equipment is self-evident.

One firm in Nova Scotia reports, after using one each 2 and 4-ton hoists constantly for one year, that "They have not cost one cent for repairs and show no signs of wear." Thus it is achieving a reputation for resisting wear like that enjoyed by the Yale & Towne chain blocks. The hoist is having a wide application both in this country and the United States.

RETURNED
APR 28 1906
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page 55
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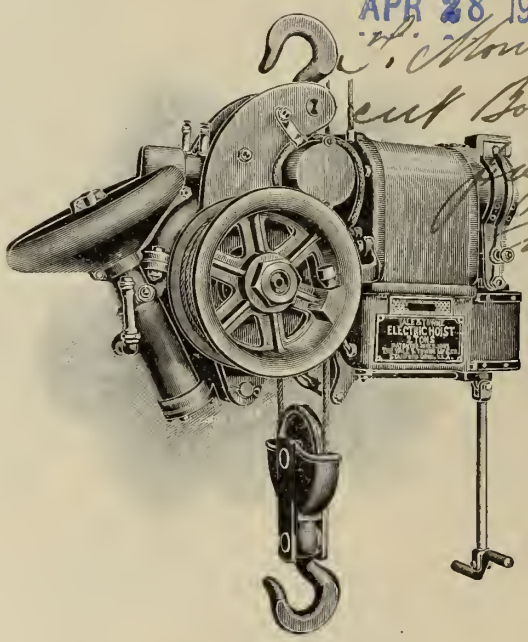


A Practical Electric Hoist.

The following plants show the variety of work to which it has been adopted: Machine shops, structural shops, locomotive works, foundries, bridge works, smelting and refining works, street railway shops, railroad repair shops, ship yards, United States navy yards, car works, iron and steel works, sheet and tube works, boiler shops, power plants, electric light plants, building and construction, warehouses, erecting shops, etc. The Canadian Fairbanks Company, Limited, Montreal, Canadian sales agents for the Yale & Towne Co., will be pleased to give any further particulars desired.

THE IMPROVED FRICTION COUNTERSHAFT.

ACCOMPANYING engravings show a new friction countershaft which is quite an improvement over now existing forms.

It is noted particularly in respect to driving power, ease of operation, noiselessness, and in giving the workman perfect control of his machine. Its driving power will be understood when it is pointed out that the friction shoes are screwed into contact with the rim, a tight engagement being thus obtained with a very small effort at the shifter lever. The force required to engage this clutch is so small that with the tip of the finger at the shifter handle, the friction is set tight enough to slip the belts. It will be noticed that the friction gradually engages and that the operator can apply any desired amount of driving power to his machine. The extent to which this feature can be utilized is shown by the fact that a piece of work may be put on the lathe centres and cut in two with a parting tool without danger of breaking the tool, because the friction can be set just tight enough to drive the cut and to slip when the piece comes apart and pinches the tool. There are many other occasions on which this feature is useful, as in bottom tapping, or at any time when tool or work can be protected against breakage by the slipping of the friction. This same property makes it easily possible to slack down the speed for measuring or examining the surface of the work when stopping would leave a mark on the work. When used over a lathe it can be used as a brake to quickly stop the machine by lightly engaging the "backing" friction before bringing the handle to the "off" position. The makers have spared no pains to make this countershaft very good all around. Instead of the old two-point suspensions the self-oiling boxes are so supported as to be free to swing in all directions and will not bind the shaft if the hangers are not put up squarely. No tools are required to adjust the friction, and belts are not thrown off for this. The pulleys run on sleeves set-screwed to the shaft, providing a large bearing surface and containing the oil holes, so that the belts need not be thrown off for oiling. The drip-cups are taken off by withdrawing a cotter pin, doing away with all spilling of oil, as with those that have to be screwed out when full. Taking everything in consideration this countershaft ought to add materially to the output of the machine it is used over. It is made by the Wilmarth & Morman Company, Grand Rapids, Mich.

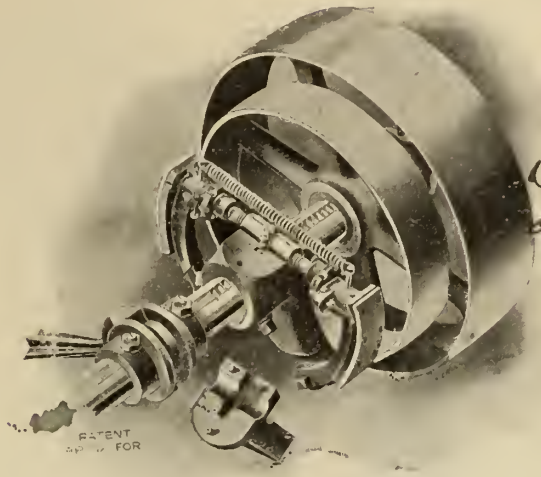


Fig. 1 Improv d Friction Countershaft.

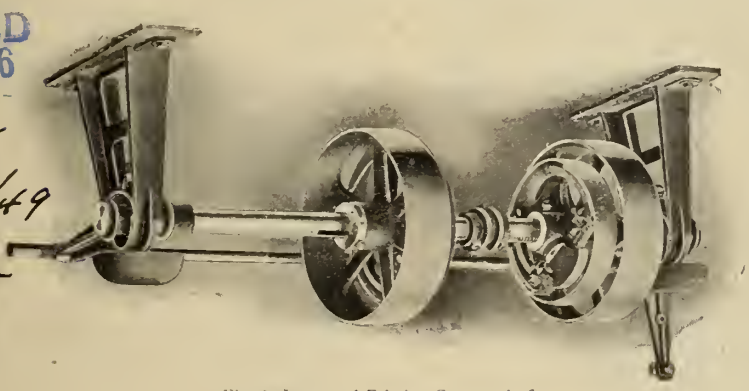
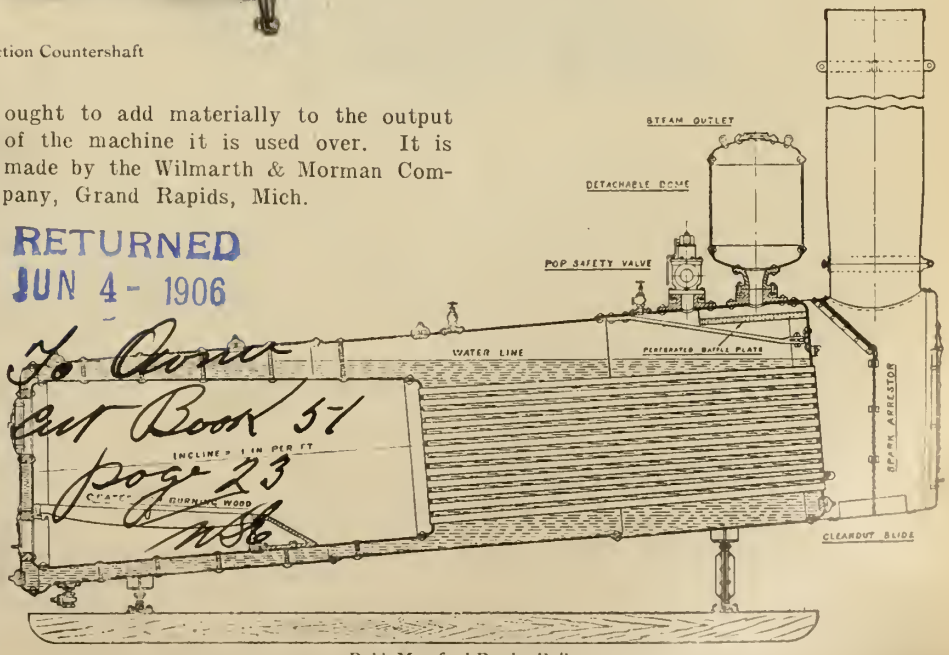


Fig. 2 Improved Friction Countershaft

ROBB-MUMFORD-BRADY BOILER.

IN the Maritime Provinces there has been a great demand for a suitable portable boiler for saw mills, and to meet this demand, the Robb Engineering Co. have recently designed a boiler known as the Robb-Mumford-Brady portable boiler, which is illustrated herewith.

This boiler, as will be seen from the accompanying cut, consists of a cylindrical shell, with an inclination from the horizontal of about one inch to the foot, having in it a cylindrical fire box. The fire box is tapered, making it parallel with the shell on the bottom, allowing ample space between the fire box and the shell for water, while the top is parallel with the water line. The tubes ex-



Robb-Mumford-Brady Boiler.

tend from the back end of the fire box to the back end of the shell, running parallel as in a locomotive boiler. This permits the water line of the boiler to amply cover both the fire box and the tubes and furnishes a large disengaging surface for the steam to rise from the water without foaming. In a marked degree this boiler combines safety, durability, simplicity, capacity, portability and economy, coupled with quick steaming power, good circulation, and low first cost.

The boiler is constructed with a water front, instead of a casting, so that there is no cast iron exposed to the fire, and is provided with three hand-holes in front at the top, in line with the top of the fire box, which permit the use of a scraper for cleaning the entire top and sides of the fire box. A hand-hole is also placed in the front head below the fire box, in the rear below the tubes, and on top of the shell in line with the tube sheet for full examination and cleaning purposes. The rings forming the fire door and ash door openings are of forged steel, and the doors are made of heavy steel plate fitted with baffle plate. The lower portion of the shell at front end, near blow-off, is flanged slightly, thus forming a pocket for the deposit of any sediment and for the admission of a hand-hole. The rear end of the fire box is flanged on the sides, making the tube sheet oval in shape, thus bringing the tubes parallel with the sides of the shell, as shown, and in vertical rows. The fire box is cylindrical, the tube sheet only being oval.

The boiler is provided with a detachable dome, having the heads dished equal to the radius of the diameter, and is attached to the shell by means of steel nozzles, the nozzle on shell having slotted holes. All nozzles for safety valve and other fittings are cast steel rivetted to shell for flanged fittings. A dry pipe is also provided with perforated or slotted holes on top, having an area equal to seven times the steam outlet. The smoke box is made of 3-16 inch steel plate, attached to the boiler by slotted studs and steel keys, and being detachable, can be removed readily for handling. The rear end of the smoke box and tube cleaning door are made of heavy steel plate, the door being fitted with a baffle plate, and provided with an attachment to support the door in position for cleaning tubes. When necessary, or when wood is used for fuel, a detachable spark arrestor is provided in smoke box. This spark arrestor is made of heavy steel wire netting and is so arranged that it can be removed instantly for cleaning the tubes, and being in a vertical position, sparks will not adhere to it. The spark arrestor is of ample area so that it will not affect the draft, and a sliding clean-out door is provided in the bottom of the smoke box.

The boiler is supported on two saddles of steel and angle iron construction, being light and strong and so fitted that they may be easily detached for rolling the boiler if desired.

No cast iron work whatever is used, except the grates and bearers, which can be made to suit wood or coal, and either plain or rocking pattern, as desired.

to London Office
Cut Book 56
Page 69
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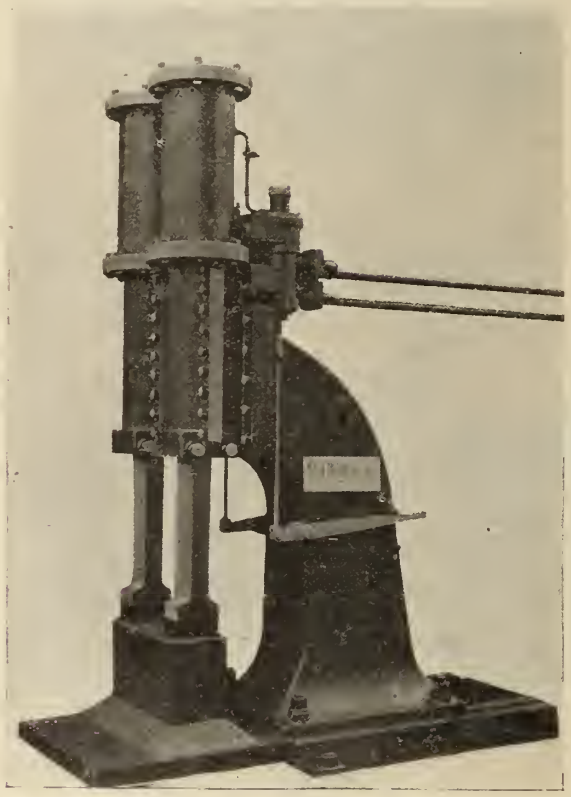

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Pilkington Compressed Air Hammer.

PILKINGTON POWER HAMMERS.

IN a previous issue some reference was made to this new line being manufactured by Peter Pilkington, Limited, 75a Queen Victoria street, London, England, since when further particulars have been received and two illustrations are shown. The saving affected by the use of these compound compressed air hammers over steam is about two-thirds in fuel, rendering them powerful and economical. They are worked from an air compressor through the medium of high and low pressure receivers. The hammer has two cylinders, one above the other, the top one being the low pressure cylinder for lifting the head and the lower cylinder is used for making the blow by high pressure air. After a blow has been struck the same air is conducted into the low pressure cylinder and is again used for lifting. Light blows and lifting of the tup are always effected by low pressure air. It is claimed for these hammers that they will do anything a steam hammer will do, will strike dead blows, hold down and squeeze, and, if necessary, can be made to work self-acting, as well as by hand lever.

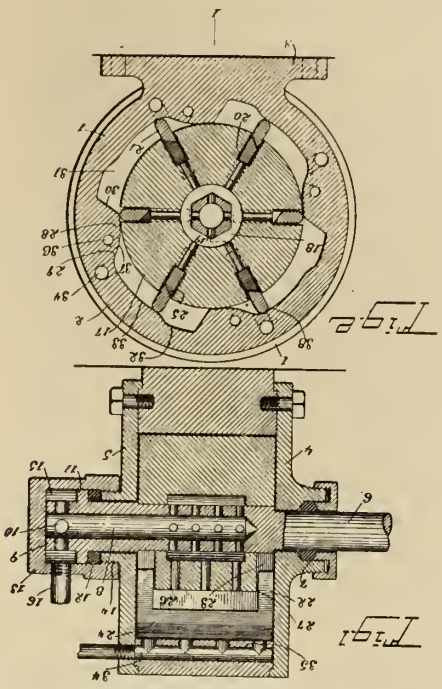
MORE ROTARY ENGINES.

A FEW months ago an account of the Canadian built rotary engine was given in these columns. Recently, two other rotary engines have been brought before the public. One of these was on exhibition in Madison Square Garden as being suitable for propelling automobiles, both for furnishing power and electric light plant. Among the advantages claimed for this engine are that the cost of construction will be about one-half less than the present machines. The economy of steam by this system of cut-off and expansion is, in every particular, equal to the Corliss

engine, and its speed can be varied from 50 to 3,500 revolutions a minute. It is reversible and its adaptation for all kinds of boats will fill a long-felt want, as it can be connected direct to the propeller shaft, and for generating electricity it will be adopted for the same reason.

Another, patented by Robt. C. McLean, of Cleveland, is shown in the accompanying illustration. Further interest is added to this from the fact that part of it was built at the Canada Machinery Co's plant at Point Edward, where the inventor was employed for some time. This engine takes steam 24 times per revolution as positive piston motion, steam expansion, and no back pressure. Steam is admitted into directly opposite expansion chambers simultaneously, while two other pistons are working under expansion, thus four pistons are always at work, so placed as to make the engine practically frictionless.

The operation of this engine is as follows, it being understood that the direction of rotation is to the right, that is, with the hands of a clock. The presence of steam in the steam space 26, forces the pistons or valves 21 outwardly, maintaining their rounded noses 38 against the wall of the casing. In the position in which the drum 17 is shown



New Rotary Engine.

25 of the pistons are disposed beyond the periphery of the drum 17, so that the steam behind the valves is allowed to escape. This steam filling the expansion chambers behind the pistons, of course, operates to rotate the drum and advance the pistons in the direction of the elevated faces 33 and toward the inclined faces 29. When the rotation has continued sufficiently, the exhaust-ports 34 are uncovered at their branches 35, so that the steam escapes, creating an exhaust from the expansion chamber. The steam which remains in the chambers in front of the pistons when they have passed beyond the exhaust ports 34 is expelled through the auxiliary ports 36. In this way no back pressure is developed at the abutments 28 which might tend to prevent the rotation of the engine. When the pistons pass the most elevated points of the abutments 28, they slide down or outwardly on the inclined faces 30 toward the faces 32, admitting steam again to the expansion chambers. This admission of the steam continues, of course, until cut-off occurs by the inward movement of the pistons, when they pass up to the elevated faces 33.

cut-off has just taken place. This cut-off occurs when the ends of the pistons 21 ride up from the surfaces 32 upon the elevated surfaces 33. When the pistons have their noses resting against the depressed faces 32, the inner edges

IMPROVED BOILER-TUBE CLEANER

A NEW boiler-tube cleaner having many points of interest is manufactured in Pittsburg. The most interesting feature of the tool is in the fact that its moving part is driven by a miniature water turbine. The body of the turbine is made in one casting, and within the casing is a spider which forms a bearing box containing a journal

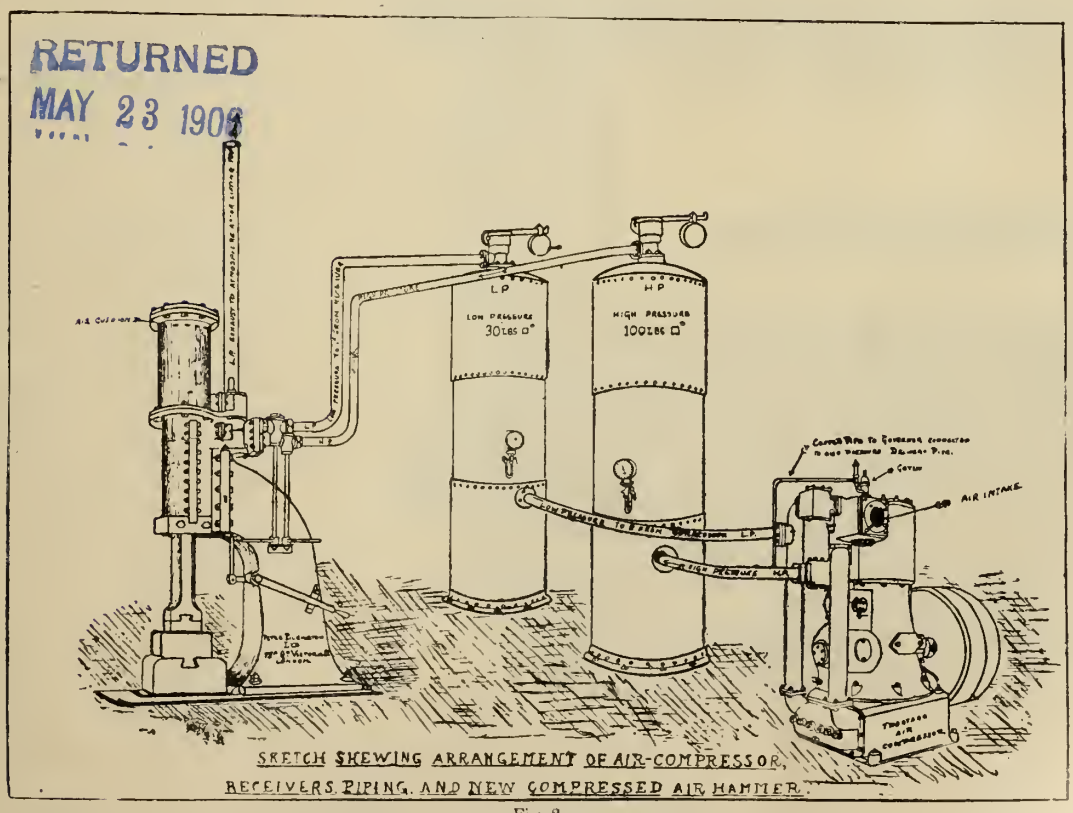


Fig. 2.

for the shaft. An oiling chamber, closed at one end, is in one arm of the spider and in the other is a ball valve through which the bearing is supplied with oil. The revolving part or turbine wheel is screwed into the rear end of the shaft, so that its weight will have a tendency to balance the weight of the cutting tool on the other end of the shaft. The stationary nozzle part, which admits water to the veins, is back of the turbine wheel. On machines for straight tubes there is used either a special hose coupling or a coupling standard pipe thread. For use in bent tubes there is provided a universal coupling which is interposed between the shaft and the freely swinging arm head, by which arrangement the machine may be used equally well in either straight or curved tubes.

NEW GASOLINE MOTOR CAR.

THE accompanying cut shows a No. 16 gasoline motor car manufactured by Fairbanks, Morse & Co., Chicago, and is one of several different styles of cars of this class they are at present building.

Early in the Summer of last year Mr. Geo. H. Webb, chief engineer, Michigan Central Railroad, made an inspection trip over the system with one of these cars, and below is some data which is

Gasoline Motor Car.

of special interest, showing as it does what has been actually accomplished with the gasoline motor. The total distance traveled by the car was 4,347 miles and the total amount of gasoline used was 231 gallons, or an average of 19.7 miles per gallon of gasoline. The records show that on the run from Jackson to Allegan, a distance of 175 miles round trip, only 7½ gallons of gasoline were used, or 23.3 miles per gallon. The total cost per mile, including lubricating oil, battery cells and everything excepting wages of man in charge, was 9-10ths of a cent. Most any railroad man can figure out that this is quite a saving as compared with a steam locomotive pulling a private car. This gasoline car has its advantages also because of its ability to attain a high rate of speed and maintain it on a long run. From Marshall to Allegan, 66.4 miles distance was made in one hour and forty minutes, or at the rate of 40 miles per hour, and they report they never stopped the engine once. The distance from Tekonsha to Harris—29 miles—was made in 45 minutes, and the best run of the entire trip was made from South Haven to Kalamazoo, a distance of 39.6 miles in 45 minutes, or at the rate of 52.94 miles per hour.

THE KERR TURBINE IN CANADA.

The Kerr turbine will be manufactured in future in Canada by William Stephenson, 24 Bay street north, Hamilton, Ont. This shop has been established for some time, and the Kerr Turbine Co., of Wellsville, N.Y., are under contract with him for the manufacture of these turbines for all purposes for which they are applicable. The particular line will be for direct coupling to generators from 2 k.w. to 300, as well as for driving blowers, fans, centrifugal pumps, etc.

WESTINGHOUSE CHARGING RECEPTACLE.

THE extensive use of electrically operated vehicles and the varied application of storage batteries for train lighting, small electric locomotives, storage battery cars, etc., has created a demand for convenient and durable accessories, one of the most important being a charging receptacle that will withstand hard usage and can be handled without danger of short-circuiting the line when inserting or removing the plug.

Westinghouse Receptacle.

With this idea in mind the Westinghouse Electric and Mfg. Co. have developed and placed upon the market a charging receptacle that will meet the most rigid requirements.

It consists of a cast metal case, circular in form, that occupies a minimum amount of space. Within the case are suitably mounted contacts for receiving the plug. A hinged lid at one end, held normally closed by a coiled spring, affords access to the interior. The receptacle being entirely enclosed effectually protects it from dirt and water.

The plug and contacts within the receptacle are so designed that it is impossible to cause a short circuit when inserting or withdrawing the plug.

The receptacle may be provided with a swivel attachment, conforming to standard railway practice, which is a decided advantage as it admits the pulling out of the plug when the vehicle or car starts, the receptacle swinging in line with the cables, and allowing the plug to pull out without danger of breaking the cables or contacts.

The charging plug shown in the accompanying illustration is intended for use with the charging receptacle. It is furnished with or without cables, as desired. The construction is rugged and all parts are well made, insuring a long period of service.

RETURNED
APR 27 1906

ABOUT CATALOGUES

By mentioning Canadian Machinery to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

Reece Screw Plate. A booklet designed to interest mechanics in connection with the Reece screw plate set of stocks, taps and dies. E. R. Reece Co., Greenfield, Mass. 3 1-2 x 6.

Jacks. Patent lever jacks, geared lever jacks, screw jacks and hydraulic jacks, are described in the 29th annual illustrated catalogue of the Joyce Gridland Co., Dayton, Ohio. 94 pages, 3 3-4 x 5 3-4.

Marine Gasoline Engines. The Hamilton Motor Works, Hamilton, Ont., are sending out a neat little booklet describing various types of gasoline engines and the motors for which they are used. Complete instructions regarding the operations of the engine are also given. 16 pages, 4 1-2 x 6.

Engineering Specialties. The 1906 catalogue of the Georgian Bay Engineering Works, Midland, Ont., besides giving illustrations and a description of the different hoisting engines manufactured by this firm, take up various special apparatus such as swinging drums for derricks, pile hammers. At the back of the catalogue useful information regarding steam and water is given. 16 pages, 6 x 9.

20th Century Machine Tools. The most complete catalogue yet issued by B. F. Barnes Co., Rockford, Ill., has just been received. It describes in some detail, with splendid illustrations, the different lines of upright drills, gang drills, lathes, tool grinders, key seaters, and special machinery manufactured by this firm. The new features incorporated in these machines are dealt with. 79 pages, 6 x 9.

Mechanical Draft. Bulletin No. 75, "What it is, what it does" has just been issued by B. F. Sturtevant Co., of Boston, Mass. This booklet not only briefly presents the salient features of this system of draft production, but illustrates a variety of plants which clearly show "what it is." The suggested query in the words "what it does" is answered thus: It does what an ordinary chimney is incapable of doing.

Gas and Gasoline Engines. The Toronto Gas & Gasoline Engine Co. have just issued a handsome catalogue describing the firm's line of manufacture. Illustrations are given of the different designs of engines made as well as the various types of motor boats. Views are also shown of plants where various sizes of these engines are installed. A number of testimonial letters are given, received from satisfied customers of the company. Size, 6 x 9.

Card Index Systems. A beautifully arranged catalogue, complete with high-class illustrations in colors, has been issued by the Office Specialty Mfg. Co., Wellington street, Toronto. This catalogue deals with the different systems devised by this firm and the many uses to which they are adapted. Forms used in these are shown as well as the ruling for the different devices. The catalogue is very complete and well arranged. 48 pages, 7 x 9.

Boilers. Robert Jenkins & Co., of Rotherham, England, have published their 1906 list of heating and range boilers, and make it the occasion to announce their jubilee year, the business having been established in 1856. The list is well printed on coated paper and contains illustrations of wrought iron boilers, (welded and rivetted), vertical boilers, hot water valves and hot water heating apparatus as manufactured by this firm. From cover to cover, there are 128 pages of matter.

Imperial Plug Driller. The latest catalogue issued by the Canadian Rand Drill Co., Montreal, Que., describes the different types of the Imperial plug driller, which is bound to have a decided effect on former recognized methods of rock excavating. Views of different operations are shown. 11 pages, 6 x 9. Another small catalogue is devoted to recent Rand productions illustrating various lines manufactured by this company. Size, 3 1-4 x 5 1-2.

The Siegwartbeam. The International Siegwartbeam Co., Lucerne, Switzerland, are sending out a very exhaustive catalogue describing the many various adaptations of the Siegwart hollow concrete beams. This catalogue is beautifully illustrated from beginning to end, describes various tests made on these beams and illustrates many buildings in which they are incorporated. All interested in cement or concrete structure work should have a copy of this catalogue. 117 pages, 6 x 9.

BOOK REVIEWS.

Shop Notes. The annual publication from Popular Mechanics, showing easy ways to do hard things. 414 pages, profusely illustrated. Price, 50 cents. Chicago: Popular Mechanics Co.

Everyone acquainted with Popular Mechanics knows the number of ideas in reference to shop kinks published each month in this interesting magazine. From beginning to end the book is full of descriptions of ingenious contrivances, most of them dealing with matters of every-day practical application. Here are to be found many suggestions for the mechanic, the handy housekeeper or the small boy, as well as information of no small value to the every-day reader.

The Honorable Peter White, by Ralph D. Williams, editor of the Marine Review. A history of the Lake Superior iron industry in the form of a biographical sketch. Cloth bound; 205 pages: illustrated. Cleveland: Penton Publishing Co.

To make a fascinating story of the Lake Superior iron industry, which is in itself one of the greatest industrial marvels in the world's history, the author has interwoven with it the life of one who was from the start a part of that industry, giving it a touch of romance and human interest that cannot but appeal to the readers of the volume. From the early days when the iron ore was drawn from the mine to the edge of the lake in sleighs in Winter time to be shipped down the lake, whence it had to be portaged past the Sault Rapids and then reshipped, to the present time when this iron trade has grown to be the greatest in the world, the reader is taken step by step and shown the various developments. Early in the history of this industry a thousand tons was a big pile to have ready when sleighing came to be drawn to the lake shore. Last year 30,000,000 tons or more were brought through the Sault Ste. Marie Canal from this source. In the early days methods were primitive, but to-day the speed and economy with which the ore is handled is a revelation to one not intimately acquainted with this field. The part Mr. White plays in this great enterprise is brought out, as well as the influence of other men on the industry. As a matter of mere interest and attractive reading the book is a fascinating one, so that anyone, whether particularly interested in the iron industry or not, could read this volume with pleasure and profit.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

A NEW HAND DRILLING MACHINE

A NEW hand drilling machine just brought out by A. B. Jardine & Co., Hespeler, Ont., embodying several important improvements is shown herewith. It is provided with the ordinary automatic feed for a post hand drilling machine, a lever and pawl taking reciprocating motion from an eccentric on the driving shaft, the pawl engaging with a ratchet wheel on the feed nut. The machine has an automatic quick return of feed. A clutch is feathered on the feed screw, and engages with a clutch on the drill spindle. When the clutch is engaged the feed screw revolves with the spindle, thus quickly running it up through the feed nut, and raising the drill out of the work. When clear of the work the clutch is disengaged, leaving the machine ready to drill another hole. The clutch is thrown in or out automatically by a lever engaging with adjustable stops which may be set at any point to suit the work. There is an arm on the lever by which the operator may throw the clutch in or out at any time, independent of the stops. The quick return is engaged and disengaged without stopping the machine, or throwing out the automatic feed.

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APR 30 1906
to Annex
our Book 49
page 61
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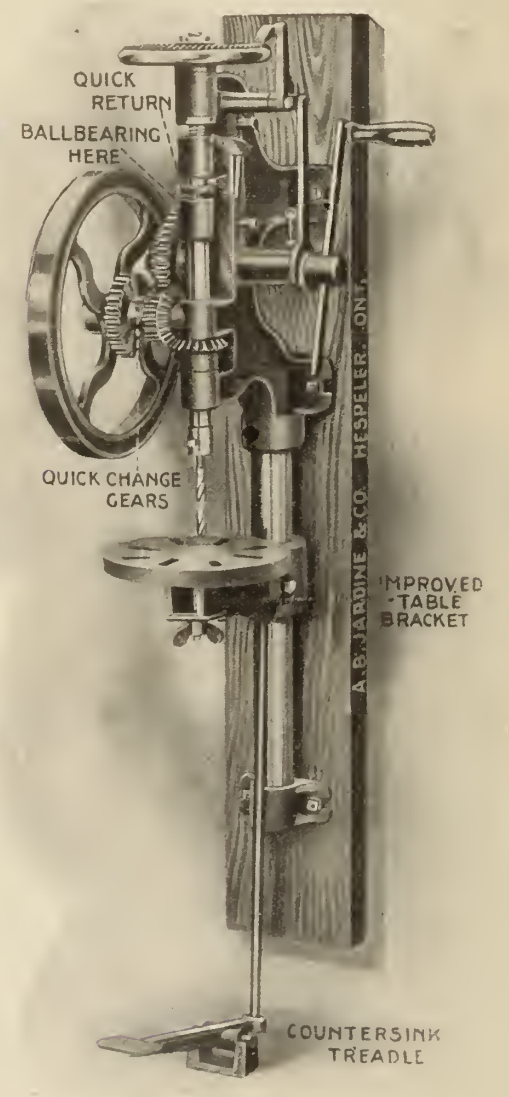


Jardine Hand Drill.

Change gears provide two speeds, for light or heavy work, the slow speed giving one revolution of the spindle, to one of the crank shaft, the fast speed two and a half revolutions to one. The change is effected by two gears 28 and 40 teeth feathered on the crank shaft, and two corresponding gears 28 and 16 teeth on a quill with mitre gear which drives the mitre on the spindle. In the engraving the 40-tooth gear which crank shaft is shown engaged with the 16-tooth gear, thus driving the spindle 2 1-2 to one. The pair of gears on the crank shaft are held in position by an arm pivoted on a stud in the frame of the machine, the outer end of the arm being forked to fall over the driving shaft and act as a collar, preventing the gears from moving endways on the shaft. To change speed, the arm is raised so as to clear the gears, the gears are moved on the shaft to bring the other pair (28 and 28 teeth) into engagement then the arm is dropped on to the driving shaft, on the other side of the gears, retaining them in their new position.

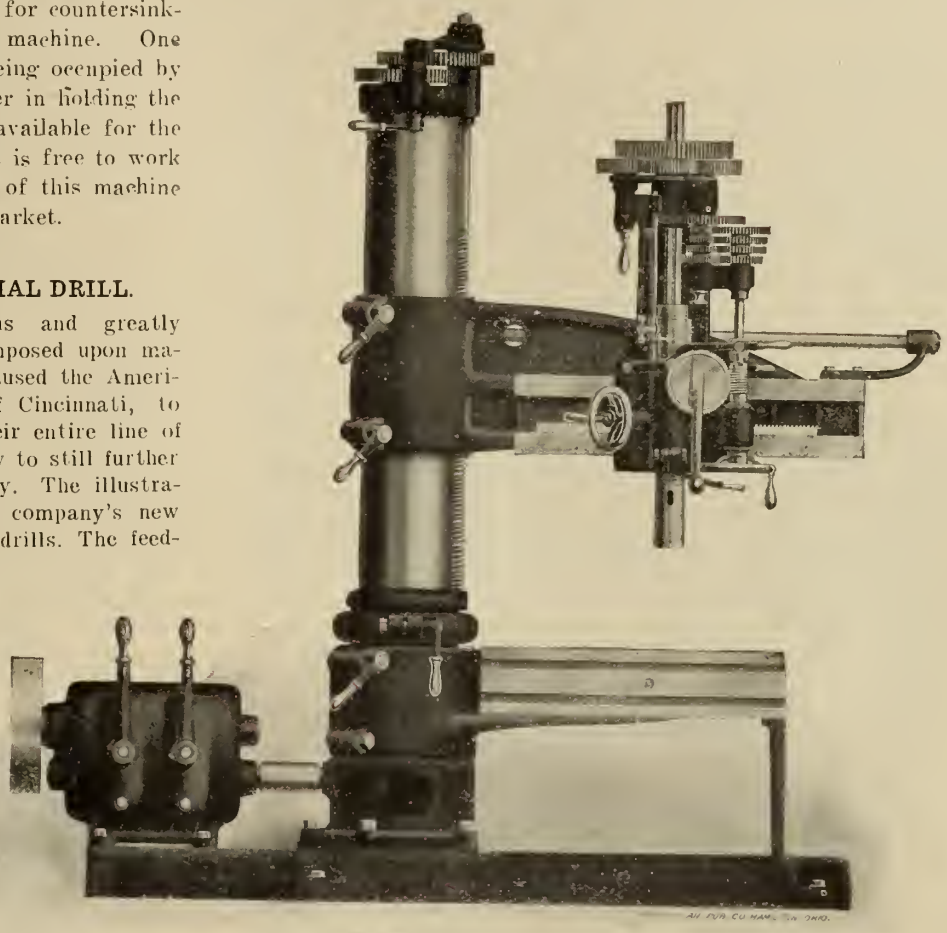
The ball bearing between the ends of the feed screw and drill spindle is held in position by the coupling, the races being of hardened steel; the lower race grooved to retain the balls, the groove being of somewhat larger radius than the balls, the face of the upper race slightly angled, forming a flat cone which keeps the balls to the outside of the centre of the groove, giving a two point bearing to the balls. The bearing is simple and effective. The table arm is held in position on the pillar by a key which occupies a recess cored in the arm. The point of the key is tapped to fit a cap screw which passes through the side of the arm. By tightening the screw, the key is drawn in between the arm and the pillar, making a quick and sure grip. By loosening the screw the arm is at once left free.

For countersinking, a treadle is used which rests on a bearing on the floor, a piece of 9-16 inch or 5-8 inch round iron of suitable length reaching from the treadle to the table arm. A key-way is cut the full length of the pillar, and

a plate with a projection which fits the key-way is fastened to the top of the table arm by a cap screw, the cap screw passing through a circular slot in the plate, the centre of the circle to which the slot is drawn being the centre of the pillar, thus when the cap screw is loosened the table arm may be swung around the pillar to any required position, and then fastened by the cap screw. The plate prevents the arm from swinging around the pillar, when the binding key is loosened, but allows it to slide freely up and down. The makers claim the foot treadle to be a much better appliance than a hand lever for countersinking on a hand drilling machine. One hand of the operator being occupied by the crank, and the other in holding the work, he has no hand available for the hand lever, but his foot is free to work the treadle. Two sizes of this machine are being put on the market.

NEW PLAIN RADIAL DRILL.

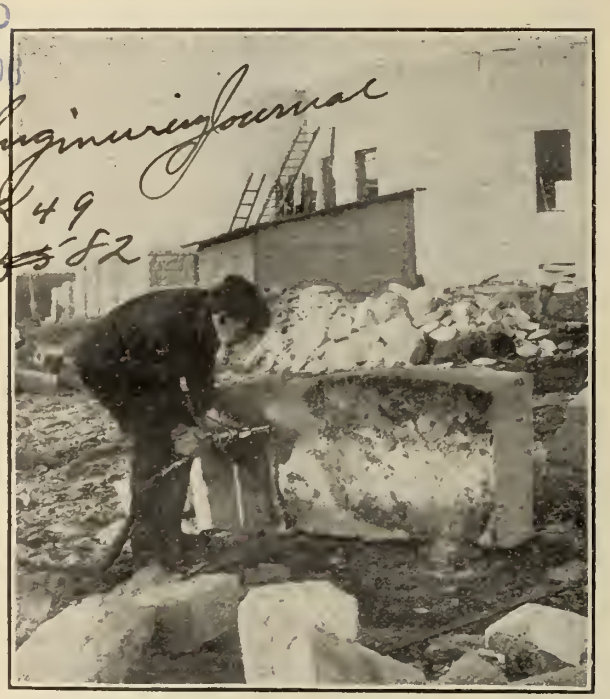
CHANGED conditions and greatly increased duties imposed upon machine tools have caused the American Tool Works Co., of Cincinnati, to completely re-design their entire line of radial drills with a view to still further increasing their efficiency. The illustration shows one of this company's new 3½-ft. arm plain radial drills. The feeding mechanism on the head provides four distinct rates of feed, covering a carefully chosen range, in geometrical progression, from .0069 in. to .0203 in. These feeds are all readily obtained by simply moving the sliding key of the feed device until the desired feed is secured. This method of feed change is by far the simplest yet devised. The all gear feeds, when supplied instead of belted feeds, insure vastly increased productive capacity, rapidity of change, and positive action. Feeds operate through a friction, which permits a drill being crowded to its limit without strain to the feed works. Feeds can be automatically tripped at any position of spindle by adjustable trip dog and pointer, acting on the worm clutch. Depth graduations are on the spindle, and all depths can be read from zero. Two or more dogs can be supplied, making it possible to counterbore any number of holes without resetting. The trip acts automatically at full depth of spindle, preventing breakage of feed mechanism. The box is of the geared friction type, providing four changes of speed, each being instantly available by use of the two levers shown. Frictions are extra powerful, employing very few parts in their construction, which can thus be made of such large proportions as to be free from slippage under the severest cuts, and obviating the use of loose delicate parts, a source of frequent breakage on most other makes of radial drills. The speed box can be easily interchanged with a cone by simply breaking a coupling connection on the lower driving shaft of the machine, base being drilled and tapped for either. A motor of any type may be attached by various methods, connection being made either direct or through gear, chain or belt. However, our experience has proven that motor on base connected by gear to 4-speed box is the most simple, efficient and serviceable method. Drive "G," in the booklet, illustrates this method. The spindle has eight changes of speed, ranging from 37 to 295 in geometrical progression, all immediately available without stopping the machine. This wide range of spindle speeds, combined with the exceptional driving power of the machine, renders the drill equally efficient with either ordinary or high speed twist drills. The column is of double tubular type. Sleeve or outer column revolves around a central column and is clamped to any position by our patent V clamping ring. This makes the outer column practically integral with the inner column, which extends almost the entire height, and has bearing for outer column at both top and bottom. This gives the equivalent of a double column, affording exceptional rigidity. Arm is of parabolic beam and tube section, giving greatest resistance to bending and torsional strain. Its design leaves the lower line parallel with the base, and thus permits work being operated upon in close proximity to the column without the necessity of an extreme reach of spindle. Arm is clamped to column by two binder levers, obviating loose wrenches, and is raised and lowered rapidly by a double thread coarse pitch screw, controlled instantly by a convenient lever. Head is moved rapidly along the arm by hand-wheel



New Plain Radial Drill.

through angular rack and spiral rack pinion. It has convenient clamping lever for locking it in any position. Back gears are located on the head, the only proper place for them, thus bringing the greatest speed reduction direct to spindle. They may be engaged or disengaged without shock or jar while the machine is in operation. Spindle is counterbalanced and has frictional quick advance and return. Tapping mechanism is carried on the head, between the back gears and speed box, thus giving to the frictions, already very powerful, the benefit of the back gear ratio, making unusually heavy tapping operations possible, and also permitting taps to be backed out at an accelerated speed. The lever for starting, stopping, or reversing the spindle is controlled at the head from the front of the machine.

RETURNED
APR 27 1908
To Can Engineering Journal
Our Book 49
page 582
Ans



Imperial Plug Driller.

THE IMPERIAL PLUG DRILLER.

THE Imperial Plug Driller is the most recent production of the Canadian. Rand Drill Co., Sherbrooke, Que. Already this tool has won for itself an enviable reputation among miners, quarrymen and contractors, and bids fair to revolutionize present methods of rock excavation. A glance at the construction of the tool will readily convince one that its lightness and compactness, coupled with the comparatively small consumption of air, fit it for the work which it is designed to do. While primarily intended for the lighter work of rock excavating, such as putting in plug and feather holes, stoping, squaring up, sinkink pop holes, drilling anchor holes and similar work, owing to its handiness, the tool is sure to find unexpected uses.

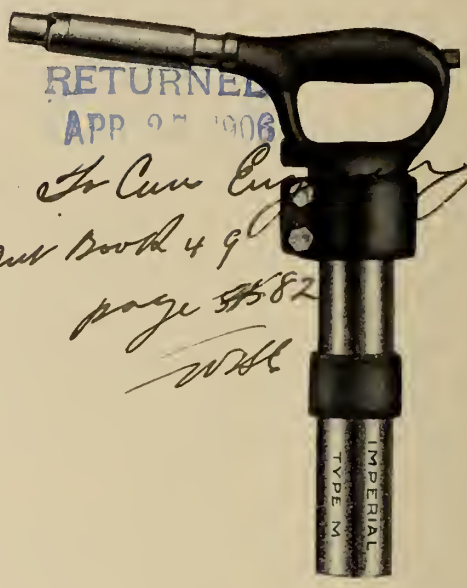
THE LARGEST ROCK CRUSHING PLANT IN THE WORLD.

THE Power & Mining Machinery Co., of Cudahy, Wisconsin, (suburb of Milwaukee) has recently closed a contract for a complete rock crushing plant to be erected for the Little Falls Stone Co., Little Falls, New York. This plant will embody all of the latest ideas in modern crushing practice and will be built throughout in accordance with designs made by the Power and Mining Machinery Co.

One feature in connection with the equipping of this plant that will be of more than usual interest, will be the enormous size of the main crusher, a No. 10 McCully, the largest machine of its kind ever designed or built. To form anything like a true conception of the immense size of this crusher, it is only necessary to state that its weight will be nearly 200,000 pounds and its capacity, under favorable conditions, 700 tons of crushed stone per hour, or 7,000 tons per every working day of ten hours. The product from this plant will be used for ballast, railroad, and concrete work. All of the dust or fine material accruing from the crushing of the stone is to be used for making cement bricks, the manufacture of which will be carried on in a near-by plant owned by the same company.

BUFFALO SHEAR.

THE accompanying cut illustrates the slitting shear, made by the Canadian Buffalo Forge Co., Limited, of Montreal. The body is of heavy armour plate and for this type of shear is



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APP 27 1908
To Can Engineering Journal
Our Book 49
page 582
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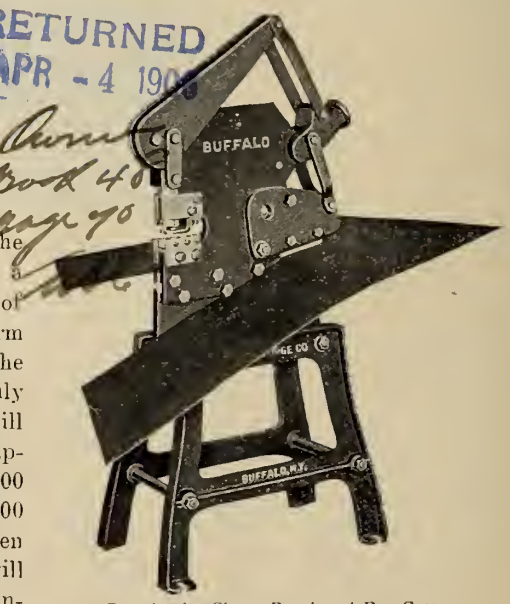
made in two pieces which are bolted together with a joint that gives clearance of the sheet beyond the blades. It has an easy capacity of No. 8 gauge and larger sizes are made for heavier plate. As this type of shear blade is not suitable for cutting bars, an attachment will be noted in the body of the punch which is for this purpose above. The No. 4 1-2 B. combined punch and shear stands

RETURNED
APR - 4 1908
To Can
Our Book 49
page 70



Combination Shear, Punch and Bar Cutter.

48 inches high, and weighs 375 pounds. The height from floor to die is 29 inches, with stand, and if required for use on a bench or block, an allowance is made by manufacturers for the stand, and the

angles at the base of the plate are drilled for holding down bolts.

The punch end of this machine has a capacity of a 5-8 inch hole in 1-2 inch plate, and the depth of throat is 5 inches. A large machine called the No. 5 Buffalo Giant punch and shear has a capacity for a 3-4 hole in 1-2 inch plate. Independent punches, independent shears, and combinations of various sizes give a large choice in selection The pygmie shear shows the form of the smallest size, which is capable of handling 1-8 inch stock.

GIGANTIC TESTING MACHINE.

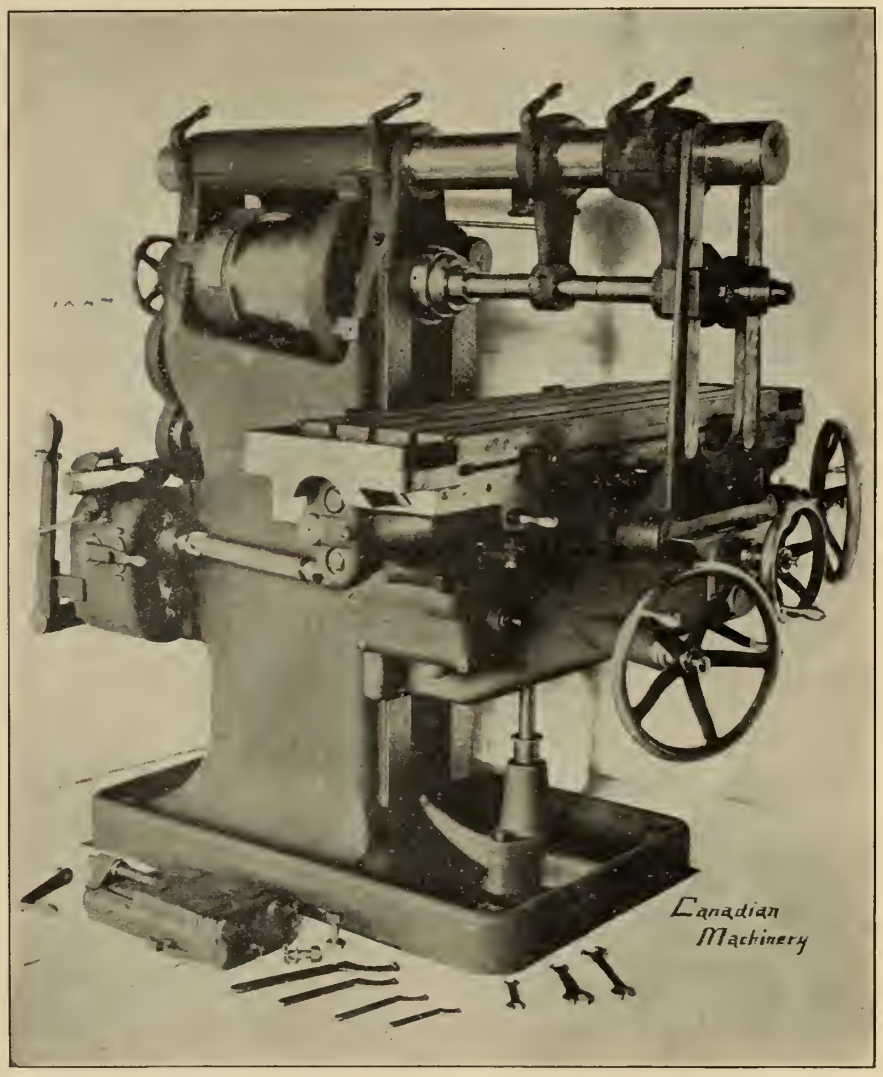
W. & T. AVERY, LIMITED, of the historic Soho foundry, Birmingham, where so much pioneer work has been done, have now under construction for the Birmingham University, engineering section, a huge machine for testing whole members of constructional work, such as complete girders, columns, and every part in the construction of bridges, roofs and machinery, in fact, the machine will test any and every part that can possibly be used in engineering work. The machine is designed to test specimens for tension, compression, and transversely. The maximum capacity is 300 tons, the total length 70 feet, and the weight of metal in the machine is about 85 tons. The machine is driven by hydraulic power, and the adjustment for testing from the largest specimen, 30 feet long, down to the smallest, is made by an electric motor, working at 750 revolutions per minute.

The machine is one of the largest testing machines that has ever been made, and is specially comprehensive, in order to give the whole range of tests. The machine is so arranged that an official can govern from one position the hydraulic power applying the strain, the electric power by which the various adjustments are made, also the recording steelyard. This machine will be a splendid acquisition to the Birmingham University, and to the City of Birmingham. A machine which will test whole members of constructional work is of special interest at the present time, as such tests should help materially to avoid in the future, such catastrophies as the recent one at Charing Cross.

PLAIN MILLING MACHINE.

IMPROVEMENTS have recently been made in the No. 4 plain milling machine built by the Becker-Brainard Milling Machine Co., Hyde Park, Mass., of which an illustration is shown herewith. Probably the most important of these is the positive gear feed drive and change feed mechanism, by which 20 changes of feed can be made without stopping the machine. The clutch mechanism in connection with the handwheels is also new, as well as the box type of knee and the telescopic elevating screw.

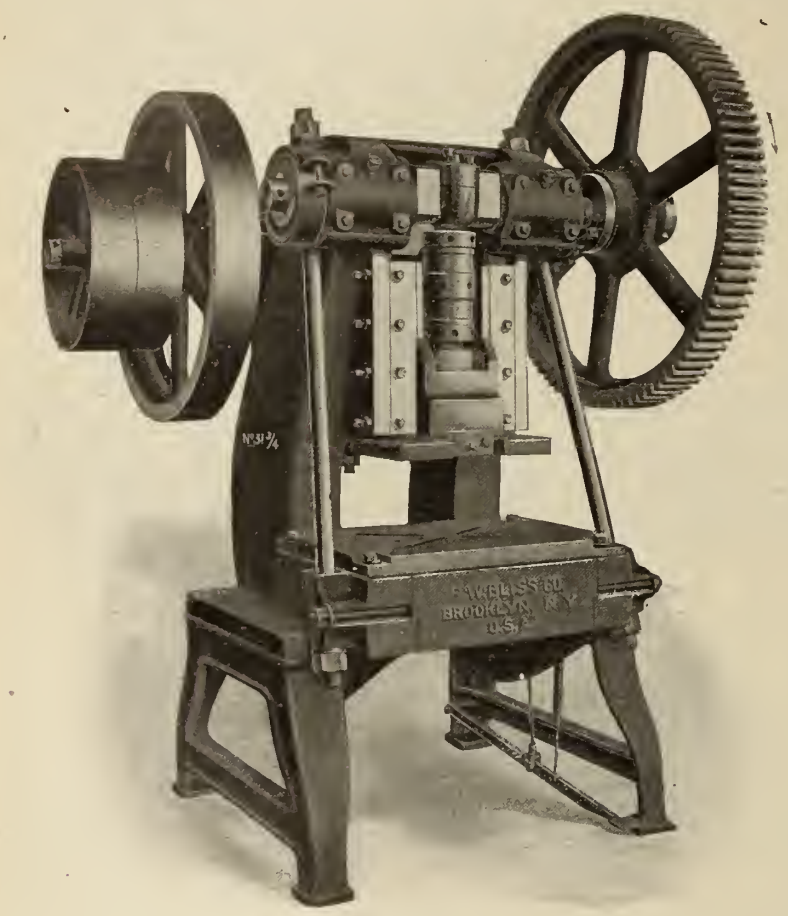
The spindle is of hammered crucible steel, has a 3-4 inch hole through it and runs in self centering bronze boxes arranged to compensate for wear. At the front end the spindle has a No. 2 B. & S. taper hole, a slot across the end to engage a clutch, the arbor and a thread to take a chuck. This screw is covered by a collar when not in use. The spindle is connected with the change feed mechanism by three spur gears, making a positive driven feed. It is double back geared, the gears being protected with shields. The arm is of steel, is arranged to adjust horizontally and has a removable arbor support, allowing the use of any attachment without removing the arm. The platen has automatic longitudinal, cross and vertical feeds. It is provided with T slots and oil pans at each end. The feed may be reversed at the front of the machine. The knee is provided with an automatic vertical feed and knock off. The hand wheels for operating the feeds have clutch members inclosed in their hubs. When the table has been set to the required position the clutch may be instantly disengaged by pressing in a knob on the front of the hand wheel. This prevents any accidental change of position of the work and avoids the revolving of the hand wheels when the feeds are in action. To indicate the vertical, transverse and longitudinal movements of the platen there are adjustable dials graduated to thousandths of an inch, which may be set at any position with set screws.



Plain Milling Machine

A NEW BLISS COMBINATION PRESS

HEREWITH is shown a new combination press useful for a wide range of sheet metal work. Besides being of a heavy and massive construction, it is fitted with stay rods, which give extra strength and rigidity. It has a cap and flange mandrel, so that the small combination dies may be fastened into the slide by their stems or the larger cutting or blanking dies may be bolted on the flange. It is usually furnished with a combination die bolster, such as is desirable in operating combination cutting and stamping dies. The front of the press-bed is removable so that a sunken bolster, a horn frame with horn or a wiring frame with slide plate may be substituted and the press be used either for closing side seams or for wiring the top edges of sheet metal bodies. The press is particularly adapted to the manufacture of enameled ware, pieced tinware, powder cans, canisters, pails, buckets, pans, etc., and may also be arranged for petroleum, biscuit and varnish cans and other square work by substituting horns of the proper shape.



New Bliss Press.

Some of the important dimensions are: Width between uprights, 16 inches; opening in bed, 16 1-2 x 25 inches; distance back from centre of slide, 12 inches; distance from bed to slide, stroke and adjustment up, 12 inches; standard stroke, 4 inches; strokes, 75 to 100 per minute; height centre of shaft, 71 1-2 inches; floor space over all, front and back, right and left, 72 x 75 inches. This press is built by E. W. Bliss Co., 20 Adams street, Brooklyn, N.Y.

INVENTION FOR MAKING STEEL.

Two important inventions in the manufacture of steel have been brought to the attention of manufacturers in Pittsburg recently, which may have a far-reaching influence on the future steel trade. One is along the lines of economy in production, and is the idea of Ralph Baggelev, of Pittsburg, who has worked out a model of an open hearth furnace, from which the gases generated from the burning metal are carried off from the furnace and over a screen, which is so constructed as to catch and retain all the iron sulphur and other impurities in the gas. The screen soon becomes fully loaded and is replaced with another. The loaded screen is divested of its load, and from the mass is extracted the sulphur which becomes a commercial commodity, and the rest, which is a slag, is used in furnaces and reduced to iron, thus saving a waste that in the long run is enormous.

The second invention is a process designed by a Cleveland man, Horace W. Lash, who has conceived the idea that by mixing the molten mass of a blast furnace running on any low-grade ore, after one portion passes through an acid-lined Bessemer converter and is blown free of silicon and other impurities and the other portion has been poured into a basic open hearth. The action of mixing the two bodies of molten metal, it is claimed, will result in making the highest grade of steel, for it will be equally carbonized and because of the large size of the charges, it will become dephosphorized by natural rules.

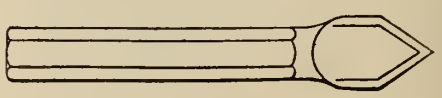
The value of the latter will be to make available all of the vast stores of low-grade ore that are found all over the country and within easy reach for the higher grades of steel. The process will also cheapen the production of steel. Both patents have been taken up with interest by large corporations for further development and from the manner in which they are studied the results will be of the utmost interest within the next year.

The utilization of the immense deposits of low-grade iron ores scattered all over the North American continent has been a dream of the steel manufacturer for years. Heretofore, the only ore suitable for the economical manufacture of steel has been confined to the Lake Superior regions, and this is now practically all controlled by a few allied interests and its quantity is so closely estimated that the life of the beds has been figured to a nicety. To extend the steel-making ores to all beds would put the end of such ores so far into the future as to practically make them inexhaustible.

HANDY MARKING CHISEL.

A MARKING chisel is a convenient tool about the engine room. One of the instances in which it can be used to advantage is in marking the eccentric so that it can be readily reset should it slip on the engine shaft.

It is often difficult to mark the eccentric and the shaft so that the lines come exactly opposite. With the tool illustrated this is made easy. The cutting edge is made as shown and not at right angles with the side. The point strikes first and makes a true mark on the eccentric hub. By turning the chisel in the opposite direction a mark is made on the engine shaft.—Engineers' Review.



Marking Chisel.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

Edmonton will spend $180,000 in civic improvements this year.

The C. P. R. pier at Quebec will be extended another 358 feet.

The Edmonton Tent & Mattress Company will build a new factory.

The Imperial Plaster Co. will erect a large grinding mill at Cayuga.

H. K Wampole & Co. will erect a box factory this year at Perth, Ont.

The Le Roi mine at Rossland, B.C., made $39,000 profits in January, 1906.

The London Fence Company will build a fence factory at Portage La Prairie, Man.

A new light and power station is about to be built in the town of Chatham, N.B.

F. B. Moffat, of Enderby, B.C., is preparing to erect a flour mill at that point.

The Montreal Mining Exchange are considering the question of holding daily sessions.

John Hinds, of Barrie, has reported making a valuable find of mica near Carney, Ont.

Work has commenced on rebuilding the C. P. R. burned freight sheds at Winnipeg.

Smith & Sherbourne have started building the Carter-Cotton building at Vancouver.

D. A. Vaughan, of St. Stephens, N.B., will build a paper box factory at Sussex, N.B.

The Twin City Brick Co., Port Arthur, Ont., are making a large addition to their plant.

The Little Bay copper mine in Newfoundland is being examined with a view to opening it up.

The Montreal Street Railway Co. will spend $750,000 in the construction of new rolling stock.

The Whitewood Implement Company are building an implement warehouse at Whitewood, Sask.

King & Crosby, Hamilton, Ont., are working on a drill which is to have several new features.

The proposed power plant for the corporation of Morrisburg, Ont., will shortly be commenced.

The Canadian-American Coal Company will spend $60,000 on a tipple and other improvements at Frank.

At the annual meeting of the Hamilton Gas Light Company a dividend of 8 per cent. was declared.

The International Brick & Tile Co. ask for tenders for the sale of their plant at Bridgetown, N.S.

The Montreal Light, Heat & Power Company will build a new office building to cost over $100,000.

The Dominion Iron & Steel Co. have begun to manufacture steel rails for the Canadian Pacific Railway.

The United States Steel Corporation has nearly 175,000 employees, one fifth of whom are stockholders.

The Manitoba Iron Works, Winnipeg, invite tenders for erection of boiler house and structural iron shop.

The Felt Roofing Company will build a new factory at Brantford, with a capacity of 25 to 30 tons a day.

The largest steel ingot that has ever been made has just been cast at Manchester, Eng. It weighed 120 tons.

The Lansdowne Park Improvement Company will erect a cement block show building at Ottawa to cost $45,000.

J. M. Gardiner, Chatham, and Wm. Milner, of Petrolia, are promoters of an auto factory to be built at Chatham.

The Cataract Power Co. will build new car sheds at Hamilton for the Radial, the street railway and the T. H. & B. roads.

An oil strike was made near Aylmer while boring for water. It is said to pump three barrels of lubricating oil per day.

The city of Calgary is advertising for industries to locate there and offers inducements in the way of power and light.

G. E. Fisher and J. D. Johnston, of Chatham, are at the head of a company who will build a grist mill in that town.

The Quebec-Jacques Cartier Water Power Company will either acquire the Quebec Gas Works or will build a new plant.

The Smith's Falls Foundry and Malleable Company has changed its name to the Rideau Malleable & Foundry Company.

The town of Smith's Falls will give a loan of $150,000 to the Frost & Wood Company to help rebuild their burned shops.

The contract for a spinning mill for the Eagle Knitting Company at Hamilton has been let. The cost will be about $30,000.

The Arbuthnot Fuel Company, of Winnipeg, has been declared insolvent, and application has been made for a winding up order.

The Borland Carriage Company, of Stratford, will build additions to its factory shortly which will double its capacity.

A site has been purchased in Berlin for the installation of a cement brick plant. J. Thussier, of Parry Sound, is the promoter.

The Imperial Oil Company will shortly commence the erection of a candle factory in Sarnia. It will be three storeys high, of brick.

The Lake Superior Corporation has adopted plans for new open hearth furnaces at the Soo, and contracts are about to be let.

The Peterboro. Sandstone Brick Company will commence work on their new plant and expect to be turning out brick by May 1.

The Toronto Board of Control has under consideration the purchase of the Erindale plant of the Southern Light & Power Company.

The by-law to raise $15,000 to establish an electric light plant in the town of Carberry, Man., has been carried by a large majority.

Cayuga, Ont., ratepayers carried a by-law to raise $5,000 to purchase 50 acres of land for the Pittsburg Window Glass Machine Company.

The Imperial Bank have opened a branch in Red Deer, Alberta, and also contemplate opening branches in Quebec, London and Banff.

S. R. Rudd, of Arnprior, has been awarded the contract for the erection of a shirt factory to be operated by a Montreal company.

Toronto building permits for the first two months of this year amounted to $836,000, as compared with $594,000 for same period last year.

The value of mineral products for 1905 in Canada was $68,574,707. Coal amounted to $17,000,000, copper $7,420,451, lead $2,634,084.

Seaman, Kent & Co., Meaford, Ont., have placed their third order within two years for a Cumber dry kiln with Sheldon & Sheldon, Galt, Ont.

Plans are being prepared by the city engineer, Edmonton, Alta., for three miles of street railway, which it is proposed to build this Summer.

Gibson & Company's roller mill at Morrisburg was destroyed by fire on the 20th inst. The loss is about $25,000, partly covered by insurance.

The Canadian Flax Cordage Company purpose building a factory at St. Mary's, Ont. The town is surrounded by a good flax-growing district.

Walkey Bros.' furniture factory, Fordwich, Ont., was destroyed on the 20th inst. by fire. The loss is over $5,000, covered by insurance of $2,700.

The Edmonton council reported in favor of giving the C.P.R. $25,000 on condition that the shops for the northern extension be located in that place.

The Indestructible Fire Brick Company, who have been busy installing their plant at Mimico, expect to employ ninety men when in full operation.

M. P. MacNeil & Co., of New Glasgow, N.S., have secured contracts for erecting buildings for the Acadian Coal Company to the value of $50,000.

Upon the completion of their smelters at Port Arthur, MacKenzie & Mann will probably erect rolling mills there, similar in size to those at the Soo.

The Department of Trade and Commerce announces that the bounty on lead is still suspended, as the price continues a shade over the bounty figure.

Amherst, N.S., will expend $80,000 on local improvements, including extension

of waterworks and sewage systems, and additions to the Winter Fair buildings.

A very rich peat bed has been discovered near Schomberg, Ont., on the line of the Trent Valley Canal extension, and a company will be formed there to work it.

The Great Northern Railway is said to be surveying for a line to run northwest from Burnha, Montana, to Medicine Hat, Alta., and from thence to Edmonton.

It is stated that Chas. J. Coll, of the Acadia colliery, Stellarton, N.S., has purchased the coal areas of the Cumberland Coal & Railway Co., located at Broughton.

Capt. P. N. Thompson, Vancouver, has applied for thirty acres adjacent to Nairn Falls, on the Green River, for the purpose of developing a waterpower there.

The Canada Plate Glass Company suffered loss by fire on Tuesday last to the extent of $15,000. The fire occurred in their Richmond street, Toronto, warehouse.

The Lake of the Woods Milling Company have plans completed for the building of two more mills this year, one at Montreal and the other at some point in the West.

The Peacock File Co. intend removing their entire plant from Buffalo to some point in Canada. They employ about fifty hands and may locate at Port Colborne.

A charter is being sought for the East Toronto and Danforth Electric Railway Company, which purposes building a line from East Toronto to St. Lawrence Market.

The Chas. Fawcett Manufacturing Co., of Sackville, N.B., will build an addition 65 by 120 feet to their molding shop, and will also enlarge their steel range building.

Hamilton citizens are discussing an electric railway from Hamilton to Guelph Junction for the purpose of a more direct lake connection with Goderich and Owen Sound.

Macleod, Alta., is looking forward to a busy season in building. A grist mill, a storage plant and the new Hudson Bay stores are among the larger buildings to be erected.

Blairmore, Alta., is to have a bottling works. The plans call for a solid stone building 25 x 50 feet. The Rosse building has been started, and other buildings are contemplated.

The Vancouver, Fraser Valley & Southern Railway Co. will ask incorporation at the next session of Parliament to build an electric railway from Vancouver to New Westminster.

The Roberts Heating & Ventilating Co., of Minneapolis, intend to erect a warehouse and branch factory in Winnipeg during the coming Summer, to be valued at $20,000.

W. H. Banfield & Sons, Adelaide street, Toronto, have increased the capacity of their plant during the past month by a further addition of up-to-date machine tools.

The Grand Trunk has secured an option on the Cowey block, Ottawa, for $225,000, and if the deal goes through they will pull down the building and use the land for terminals.

Agents of J. J. Hill are spying out the land in Saskatchewan and making large purchases. It is said this is only part of a project to build a line from Lethbridge to Winnipeg.

It is understood that Heinze, the Montana copper king, has secured working options on forty British Columbia mines, and that a smelter will be in operation within a few months.

The contract for grading the Midland Railway of the Great Northern system from Portage Le Prairie to the international boundary has been let to the Guthrie Company of St. Paul.

Carberry, Man., will build and own its own electric light plant, which will cost about $12,000. The building will be such that it can be enlarged should the town decide to also own its telephone.

Thirty members of the Canadian Manufacturers' Association have already applied for space at the New Zealand International Exhibition which will open at Christchurch in November next.

The Hamilton Pattern Works have completed the installation of the equipment of their pattern shop on Bay street, Hamilton, Ont., and are already finding a demand for their services.

The work of developing power from the Kakabeka Falls, 16 miles west of Fort William, is nearing completion, and by the 1st of June, 1906, electrical energy will be supplied to the twin towns.

The total output of British steel ingots for 1905 was 3,879,000 tons, an increase over the previous year of 634,000 tons. The principal finished product of this industry is for shipbuilding.

The Vancouver Furniture Manufacturing Company will commence operations next month. The factory will use native woods and will be 50 by 100 feet in size. Machinery is now on the way from the east.

A Manitoba blacksmith is said to have discovered a chemical process for tempering and welding copper. A. McMillan, of Winnipeg, has secured patent rights for this method in Canada and other countries.

The by-law granting a 99-year franchise to the Western Power Company of Brandon has been reconsidered, as an act of the Legislature prohibits the granting of such franchise for more than 30 years.

The Montreal Power Company have plans to place a considerable portion of their wire underground. They will commence work as soon as the frost is out of the ground, and will expend this year $100,000.

Greenshields & Greenshields, of Montreal, have made an offer on behalf of unknown clients to lease the New Brunswick Coal & Railway line and rolling stock for 999 years at an annual rental of $21,000.

A large brick yard is to be established at Melfort, Sask., by a Toronto company with which E. Hawke is connected. It is also announced that the Standard Oil Company will build a warehouse there.

The Pupay Electric Meter Co., of Peterboro, Ont., are having the first of their meters tested after which they purpose going into the manufacture of this new and promising line on an extensive scale.

The Peterborough Sandstone Brick Co. have purchased a carload of machinery for their plant, and upon its arrival will go right ahead with the work of getting everything in operation to meet the season's trade.

The Brandon Electric Light Company are preparing to make large extensions to their plant at Brandon, Man. A new brick station will be erected in which modern boilers, engines and generators will be installed.

Greer Bros., of Port Arthur, have secured the contract for supplying 2,000,000 ties for the new transcontinental railway, to be delivered this Summer. This is the largest contract of its kind ever given in Canada.

The Lake Superior Co., Sault Ste. Marie, Ont., will build a large addition to their steel works. A building 200 by 110 feet will be erected. The new furnaces will cost some $250,000. A coke plant will also be installed.

The Government of Nova Scotia will assist in the building of a railway from Halifax to Guysboro by giving a loan. Sir Montague Allan, of the Allan Steamship Line, is at the head of the syndicate who will build the road.

The smelter of the Granby Copper Co. is making a record run, treating about 2,800 tons of ore daily. The management is enlarging the furnaces and expects to increase the smelter capacity to 3,000 tons per day.

The Lakefield council have decided to submit a by-law to the ratepayers regarding the taking over of the Lakefield Light & Power Company's plant at the price of $5,500, also the raising of $2,500 for improvements to the plant.

Contracts are about to be let by the Lake Superior Corporation for the construction of a new open hearth blast furnace, to cost $250,000. It will have a capacity of 200 tons a day, and will be in operation within six months.

The Canada Foundry Company is arranging for large extensions to its Peterboro plant. The new allotment of 11,000 shares of stock has been all subscribed for. In all there are nearly 1,000 shareholders in this company.

The net earnings of the Temiskaming Railway for 1905 were $113,772, the percentage of gross earnings to operating expenses being 55 per cent. Track-laying northward is now going on and they expect to reach Black River by June 1.

The new taxes to be imposed by the Quebec Legislature will include all kinds of corporations, in varying amounts according to their capital stock. A tax of five dollars will also be levied on automobiles and a like amount on licensed chauffeurs.

The Dominion Public Works Department will call for new tenders about

April 1 for the proposed dam and locks at St. Andrew's Rapids, Man. Owing to the high water of 1904 the original plans have had to be altered to meet such exigencies.

Hon. Mr. Emmerson has announced that the Intercolonial railway shops, which were destroyed by fire, will be rebuilt, and that plans are already under way. Temporary shops will be put up at once.

The North Atlantic Collieries Co. have plans under way for development work at Port Morien, C.B. Messrs. Hyde and Patterson have been looking over the site with a view to contracting for the sinking of the shaft.

The Southwestern Traction Company, of London, are negotiating with the Ingersoll Town Council for the privilege of entering the town in connection with the electric railway line which they intend building from London to Hamilton.

The miners of Galt coal in Southern Alberta have asked for a minimum wage of $3 per day of eight hours. recognition of the union and the right to employ check weighers. The managers will confer with the men. but are averse to making the concessions.

The Brintin Carpet Factory, of Kidderminster, England, which intends establishing a carpet factory in Canada, has about concluded negotiations to locate in Peterboro. The company will employ about 75 hands and will be given a site and exemption.

At the annual meeting of the Bell Telephone Co. it was decided to increase their capital stock from ten to fifty million dollars. It is the intention of the company to strongly oppose the movement in the west, for a Government-owned system of telephones.

Fred. Hobart, of New York, in the course of a speech at the Mining Institute banquet, in Quebec, stated that it would not be long before the United States would have to look to Canada for their iron, as the American ore was becoming rapidly exhausted.

The council of the Montreal Board of Trade has decided to send a delegation to England to attend the sixth congress of the Chambers of Commerce of the Empire. The delegates will be F. H. Mathewson, Geo. L. Cains, George E. Drummond and George Hadrill.

The Quebec Southern Railway will be extended from St. Francois to Chaudiere Junction, and it is expected that the road will be in operation as far as Becarcour by the month of September. From there to Chaudiere will require several more months to construct.

The Terminal City Ironworks is the name of a new firm which has opened up for business in Vancouver. They make a specialty of handling engine and machine repairs. The new firm is composed of H. J. Littler, T. W. Littler and J. Mason, all practical men.

The city of St. John, N.B., will ask the Legislature for power to take a lien for taxes on the property of deceased persons, and bankrupt estates. They will also seek power to buy or expropriate the gas plant operated by the Street Railway Company, and to operate street railways in Cardston, a section of the city where there are no lines.

Calgary city council has decided to submit a by-law to the people to raise $100,000 to improve the waterworks, and $30,000 to extend the electric lighting system. The council also decided to assist manufacturers employing over twenty-five men, by tax exemption.

The Anthony Wire Fence Co., who have been operating in Windsor for some time past, have been receiving offers from other points to induce them to leave. Unless Windsor makes certain concessions it is probable that one of these other offers will be accepted.

Building permits for January and February in Winnipeg amounted to $328,000. Some of the principal buildings to be put up this year are the new Grain Exchange, Bank of Hochelaga, city crematory addition, jail, besides several churches and business blocks.

Railway supplies, such as crossings, switches, etc., will be manufactured in Niagara Falls, Ont., by a Canadian branch of Ramapo Iron Works. Besides the Americans interested are J. W. Nesbitt, J. G. Gauld, Jas. Dickson, R. O. Mackay and A. B. Mackay, of Hamilton.

Sheldon & Sheldon, Galt, Ont., have supplied the Don Valley Pressed Brick Works with a brick drier with a capacity of 37,000 bricks a day and have installed a kiln for drying brick with the waste gases from the burning tanks in the works of the Laprairie Brick Co., Montreal.

The International Railway Company, of Buffalo, and the Toronto Railway Company purpose building an international bridge on the Niagara River below the Falls. The purpose of this bridge is the connecting of Buffalo and Toronto by a double tracked electric express line.

A company with $5,000,000 will develop the following mining interests near the boundary in British Columbia : War Eagle, Bald Eagle, Lulu, Red Rock, Missing Link No. 2, Pinhook, World's Fair and Dandy. The new company will be known as the Phoenix Amalgamated Copper Mines.

The decision of the C.P.R. shareholders to increase the capital stock of the company from $110,000,000 to $150,000,000 shows a commendable optimism and belief in the future of the country. It was announced at the meeting that the earnings during the current year would reach $60,000,000.

Canadian locomotive imports from the United States fell from $1,353,331 in 1904, to $363,524 in 1905, most of the Canadian locomotives being manufactured at home. Steel rail statistics are much the same, now that the iron and steel industries in Canada have reached such development.

The output of copper by the Granby Mining Company now averages 2,000,000 pounds per month. The furnaces are being enlarged, which will increase the smelter capacity to 3,000 tons a day. The net earnings of this company are at present equal to 15 per cent of the common stock.

A company to manufacture soda ash will seek incorporation from the Dominion Parliament. The promoters have been quietly at work for some weeks and have secured between fifty and sixty acres of salt lands near Sandwich, Ont., and also some lime lands. They will be capitalized at $1,000,000.

The Tarbrock Iron Mines in Annapolis county, Nova Scotia, are about to pass into the hands of a syndicate of Montreal and Toronto men for a consideration of $250,000. It is expected that when the new corporation gets full control the capacity of the mine will reach 1,000 tons of ore per day.

The management of the Canadian Pacific Railway have authorized the building of a thousand box cars, of the ordinary thirty-ton type, for use on the company's system. These cars, which are to be built at the Angus shops, represent an expenditure of between eight and nine hundred thousand dollars.

H. W. Petrie, who has been in the machinery business in Toronto for thirty-five years, has opened up a branch in Montreal. They will carry all kinds of engines, boilers and machinery in the Montreal branch, which will be in charge of A. W. Royan, late of John Bertram & Sons.

The parliamentary committee of the Canadian Manufacturers' Association will interview the Ontario Government with a view to amend the Assessment Act, by which they claim land tax is made excessive. The wage earners will also, through their organizations, protest against the income tax.

About 2,000 miles of railway will be tracked or graded in Canada during 1906. The Grand Trunk Pacific contracts call for the construction of 1,000 miles, the Canadian Pacific Railway Company's contracts call for between 400 and 500 miles, and the Canadian Northern Company's for a similar mileage.

Mr. N. Dyment, and A. E. Dyment have sold their timber limits, and their sawmill and shingle factory at Thessalon, to a United States syndicate for the sum of $650,000. The purchasers are E. P. Nesbitt and Geo. Nestor, of the Nestor estate, Detroit, and W. Bishop, of the Laney, Bishop Lumber Co., Chicago.

At a recent meeting of the Montreal Chambre de Commerce, the advisability of imposing a tax on United States contractors doing business in Canada was discussed. It was stated that Canadian contractors had to pay a tax in United States. The matter was referred to the committee on industries and manufactures.

Senator Domville, who has just returned from England, has made the announcement that $20,000,000 of British capital will be invested in the Canada Central Railway. It will run from Montreal to Ottawa and thence westward between the lines of the Canada Atlantic and the Grand Trunk to Orillia.

A modern steel plant is to be established at Grand Forks, B.C. Contractor M. S. Martin has the contract for the erection of the building, which will be 40 x 60 feet, and will be built in connection with the Boundary Iron Works.

The plant will turn out all kinds of steel work and will employ some ten men to start with.

The annual report of the Crown Timber Office for Winnipeg district during the fiscal year of 1904-5 shows large increases in the sales of Canadian manufactured lumber, and a corresponding decrease in the amount imported, the sawn lumber from the United States falling to one-half the former importation.

Welland, Ont., looks to a large year in building for 1906. In addition to the Plymouth Cordage Works already under construction there will be a new steel and iron works to cost $100,000, buildings for M. Beatty & Sons Co., and Robertson Machinery Company, besides extensions of the electric railway, Government drain and town waterworks.

The Brandon Electric Light Company are making large extensions to their plant in order to supply the increasing demands for power from manufacturers. They will increase their lighting and power plant by 600 h.p. and have made arrangements for the building of another power-house. It is expected that the new plant will be in operation about August 1.

The Canadian Pacific Railway has paid the Province of Quebec seven million dollars, being the amount in full of their indebtedness for the purchase in 1882 of the Quebec, Montreal, Ottawa & Occidental Railway from the Chapleau Government. The C.P.R. has been paying 4½ per cent. on this debt, but have now been able to negotiate a loan at a more advantageous rate.

New Zealand has begun to use the wood stave water pipe made in British Columbia from the famous Douglas fir. A representative of the Canadian Pipe Co., of Vancouver, made a visit to the colony last Fall, and as a result has recently closed a very large order, comprising some 30,000 feet of 16-inch pipe, and fully as much more of other sizes, 6-inch, 8-inch and 19-inch.

The Buskard Gas Engine & Machine Co., Limited, Hamilton, Ont., has been organized by S. G. Buskard, George Schnobel and Daniel Sullivan, to manufacture gas engines, brick and cement block machines and cement mixers. Mr. Buskard has given his time for many years to the development of his gas engines and expects to place on the market one which will combine efficiency and simplicity to an exceptional degree.

Many machine shops throughout Canada seem to be realizing the advantage of manufacturing a standard line and working up a demand for it. St. Clair Bros., Galt, Ont., have started to make machine handle forgings and are so satisfied with the experiment that they are making arrangements to manufacture other standard lines. This firm is also making the Griffin mill, for cement making, for the Senator Mills Mfg. Co., of Galt.

Twenty thousand horse-power is to be developed from Lillooet Lakes, B.C., by the Burrard Power Company, who will build a plant at Port Haney, on the Fraser River. It is said that on account of the elevation of these waters—four hundred feet above sea level—a reservoir will be unnecessary, the natural discharge being sufficient. The area of Lillooet Lakes is about forty-five hundred acres, and the watershed feeding them is very large.

Bradstreet's in Calgary.

The Bradstreet Company, who have had a representative stationed in Calgary for some time, have decided to open a fully equipped office in that city. This move on their part is greatly appreciated not only by the local bankers and wholesalers, but also by all that trade which is more or less tributary to Calgary.

MacGregor Gourlay's New Works.

Much speculation has been indulged in by the daily press regarding the intentions of the MacGregor-Gourlay Co., Galt, Ont. A notice to the effect that this company has found their premises too small and that they were ready to sell their present machine shop and build new works had appeared in the local press. Since, it has been stated several times that they had reached one decision or another.

A few days ago, however, a representative called to secure definite information regarding their intentions. Mr. MacGregor, in reply to inquiries, said: "You may say that we need to increase our production, that we hope to erect new works, but that no decision whatever has been reached regarding the matter."

First Automobile Show.

The first automobile and motor boat show to be held in Canada is to be opened at the Granite Rink, Toronto, on March 31 and will last until April 7. Every effort has been made to make this show a complete success and present indications would show that such is already assured. A large collection of domestic, American and English cars will be shown. The Automobile Club is very enthusiastic in the matter and the extent and completeness of the show will no doubt be a surprise to many.

Boiler Interests Combined.

A $15,000,000 company has been formed by combination of the interests of the Babcock & Wilcox Co. of the United States and the Consolidated Boiler Co. Both companies make water tube boilers for stationary and marine use and conduct a large export trade. In the past they have been strong competitors for foreign trade and this combination thus brings together the manufacturing facilities of two of the largest makers in the world. This merger will not affect the Canadian interest of Babcock & Wilcox, Limited, as the Canadian branch is connected with the Glasgow company which has a different organization from the American firm.

London Machine Tool Co. in Hamilton.

With their handsome and modern factory building completed, the London Machine Tool Co., of Hamilton, have moved their equipment besides installing a large amount of new machinery in their Hamilton plant. It is situated in the new industrial quarter of that city, and is equipped to manufacture with the greatest facility. Electric power at a low rate is available here. The plant is so designed that extensions may be made and with the growing business of this firm it is expected that such will materialize before long. A noticeable feature in the interior is the abundance of light that is so evenly distributed, making strong shadows entirely out of the question. All the modern heating and ventilating facilities have been adopted as well as individual motor drives for the machine tools and a complete equipment of traveling cranes and auxiliary apparatus. A railroad siding enters the main building, connecting directly to the main line, thus rendering the loading and unloading of goods a simple matter, as the floor on which the track enters is covered by a powerful traveling crane.

Crowe Foundry Partly Burned.

A serious fire occurred at Guelph on March 22, when the three-storey varnish and paint shop of the Crowe Iron Foundry was destroyed. The firemen experienced the greatest difficulty in saving the adjoining plant. The molding shop was flooded with water, but otherwise no damage was done to this department. The loss is estimated at $21,000.

Jenckes' Plant Ready.

The new plant of the Jenckes Machine Co., Sherbrooke, is already ready for manufacture and in the boiler shop some operations have commenced. The new buildings include the latest style of steel and concrete structure, two in number, one being designed for boiler manufacture and the other, the foundry. Ample space was left between these two buildings for the erection of the machine shop, which will be undertaken later. In addition to this a handsome brick office building has been erected. This plant when it has received its full equipment of machinery will compare with any in this country. Full installation of machinery is now under way and it is expected to have the plant running full blast at an early date.

Electrical Contractors Organize.

The electrical contractors and supply men of Montreal have reorganized and become incorporated into an electrical section of the Builders' Exchange. The officers for this branch of the exchange were elected as follows: President, E. W. Saver; secretary, J. H. Lauer; committee, F. H. Leonard, R. Moneel, N. W. McLaren, W. J. O'Leary, S. J. Parsons, J. C. Scott.

U. S. Steel Plant in Canada.

The United States Steel Corporation has definitely decided to come into the Canadian market. They will erect their own plant, and land for this purpose has been actually bought. The papers were finally signed this week. Full details will not be made public for some time, for they are not completely worked out.

The New York correspondent of Hardware and Metal states that it may be some time before building operations begin, and the entire plant will not be finished for two or three years or longer. This will depend on the industrial development of the country.

It was stated at a meeting of the directors of the company that about $75,000,000 would be spent on the plant eventually. It is intended, however, to complete certain parts and put them in operation as soon as possible. This will entail an expenditure of $10,000,000.

There are stories, which are no doubt based on facts, that the United States Steel Corporation has acquired extensive ore areas in Ontario. One of these areas, which had been carefully examined, is reported to be the most extensive in the world. The company is said to have some undeveloped coal fields not far from Lake Erie, which will be used to supply coke for its Canadian plant.

Companies Incorporated

The Lloyd-Thompson Wire Company has been incorporated under Ontario charter with a share capital of $75,000 for the purpose of making all kinds of wire. The provisional directors are C. S. Lloyd, G. C. Thompson, and W. M. Smith, with head office at Toronto.

Galt Electric Gas Fixtures Company has been incorporated under Ontario charter with a share capital of $40,000 for the purpose of manufacturing electric and gas fixtures. The provisional directors are Henry Dakin, R. G. Struthers and M. A. Secord, with head office at Galt.

The Montreal & Great Lakes Transportation Company has been organized, with a capital of one hundred thousand dollars. The company will operate a fast and modern fleet of steamers between Montreal and Fort William, Ont., and their business, for the present, will be confined to freight.

The Canadian Northwest Coal Company has been incorporated under Dominion charter with a capital stock of $1,000,000 for the purpose of mining and dealing in coal. The provisional directors are Hon. Robert Watson, C. W. N. Kennedy ,F. C. N. Kennedy. David Philip and E. B. Nixon, with head office at Winnipeg.

The Canada Smelting & Refining Company has been incorporated under Dominion charter with a capital stock of $15,000 for the purpose of manufacturing and smelting all kinds of metals. The provisional directors are G. P. McClure, M. J. O'Brien, T. J. Gates, W. Chagnon and F. H. Wilkinson, with chief place of business at Montreal.

Winn & Holland have been incorporated under Dominion charter with a capital stock of $100,000 to manufacture and deal in iron, steel, machinery and tools. The provisional directors are P. H. Holland, Estelle L. Allien, wife of P. H. Holland, W. J. Michaud, R. A. Holland and G. A. Holland, with chief place of business at Montreal.

The Moffat Fuel Saver Company has been incorporated under Dominion charter with a capital stock of $100,000 for the purpose of manufacturing smoke-consuming and fuel-saving apparatus. The provisional directors are N. J. Ker, J. G. Turiff, E. Seybold, A. Fleck, R. C. Tate, W. H. Ostrom, A. W. Fraser, D'Arcy MacMahon and John Moffat, head office at Montreal.

The Smith Marble & Construction Company has been incorporated under Dominion charter with a capital stock of $40,000 for the purpose of carrying on the business of contractors and builders. The provisional directors are Peter Smith, Allan Smith, D. A. Campbell, W. J. Henderson and A. C. Calder, with with head office at Ottawa.

Dynamic Machine Works has been incorporated under Dominion charter with a capital stock of $15,000 for the purpose of manufacturing electrical apparatus and machines. The provisional directors are S. Humphreys, G. Humphreys, E. J. Featherstonhaugh, Lloyd Blackmore and W. G. Throsby, with chief place of business at Montreal.

The Cobalt Silver & Copper Mining Company has been incorporated under Ontario charter with a share capital of $500,000 for the purpose of carrying on a general mining and development business. The provisional directors are F. E. Ketchum G. P. McCallum, C. W. Baldwin, C. J. Brook and C. H. McBean, with head office at Sault Ste. Marie.

The Canadian Bag Company has been incorporated under Dominion charter with a capital stock of $1,000,000 for the purpose of manufacturing bags, jute, linen, cotton cloth, twines, etc. The provisional directors are H. R. Drummond, H. L. Rutherford, Edgar McDougall, A. W. P. Buchanan, G. L. Cains and J. S. Robertson, with head office in Montreal.

Sanderson Pearcy & Company have been incorporated under Ontario charter with a share capital of $100,000 for the purpose of taking over the Sanderson Pearcy business and continuing it as manufacturers and dealers in paints, colors, etc. The provisional directors are Sanderson Pearcy, C. N. Haldenby and J. D. Craig, with head office at Toronto.

Sheldons Limited has been incorporated under Dominion charter with a capital stock of $200,000 for the purpose of manufacturing and installing heating, ventilating and drying systems and structural steel, etc. The provisional directors are W. D. Sheldon, S. R. Sheldon, J. M. Sheldon, W. H. Sheldon and J. R. Blake, with chief place of business at Galt.

The Dominion Foundry Supply Company has been incorporated under Dominion charter with a capital stock of $50,000 for the purpose of manufacturing and dealing in foundry and machine shop equipments. The provisional directors are D. S. Donald, J. F. Gaffney, G. H. Weaver, E. W. Gilman and E. H. Bennett, with chief place of business at Montreal.

The James Bay Mining Company has been incorporated under Dominion charter with a capital stock of $20,000 for the purpose of carrying on a general mining business. The provisional directors are Adam Burwash, Duncan Lunam, Patrick Gibbons, R. S. Smith, Norman McCuaig and M. J. Malone, with chief place of business at North Temiscamingue, Que.

Hydrogenic Fuel Company of Canada has been incorporated under Dominion charter with a capital stock of $100,000, for the purpose of manufacturing furnaces and apparatus for the combustion of hydrogenic fuel. The provisional directors are J. C. Simpson, P. M. Robertson, S. A. McMurty, F. H. Shaw, and F. G. Bush, with chief place of business at Montreal.

CONTENTS

Modern Canadian Mfg. Plants.... 129
Plant of Standard Bolt & Screw Co., Limited.
Half Million Machinery in Demand 133
Editorial 134
The Niagara Power Problem to Ontario.
Boon by Electric Smelting.
Information for Foundrymen.
Municipalities Aiding Industries.
Technical Education for Clay Workers.
New Field for Gas Engines.
The Niagara Power Problem..... 136
Personal 137
Tricks of the Trade 138
Mechanical Review 139
Shop Tools and Devices.
Work Setting Tool for Lathe and Boring Mills.
How to Balance Pulleys.
Tool for Turning Wrist Pins and Tumbling Shafts.
Ready-Made Lathe Tool.
Jacks for Pump Pipes.
Starting a Gas Engine.
Compasses for Metal Work.
Milling Cutters, Their Use and Abuse 142
By John Edgar.
Designing a Wood-Working Molder 143
By T. C. Robertson.
Labor Saving Devices of a Modern Factory 144
By J. G. L.
Foundry Facings 145
Practical Questions and Answers.. 146
Machine Shop Costs 147
By G. C. Keith.
Electric Smelting Assured 148
Les Chats Falls.... 151
Power and Transmission.... 152
Smart-Turner Centrifugal Pump.
A Practical Electrical Hoist.
Improved Friction Countershaft.
Robb-Mumford-Brady Boiler.
Pilkington Power Hammers.
More Rotary Engines.
Improved Boiler-Tube Cleaner.
New Gasoline Motor Car.
Kerr Turbine in Canada.
Westinghouse Charging Receptacle.
About Catalogues.... 157
Book Reviews.... 157
Machinery Development.... 158
A New Hand Drilling Machine.
New Plain Radial Drill.
Imperial Plug Driller.
Largest Crushing Plant.
Buffalo Shear.
Gigantic Testing Machine.
Plain Milling Machine.
New Bliss Combination Press.
Invention for Making Steel.
Handy Marking Chisel
Industrial Progress.... 163
Companies Incorporated.... 167

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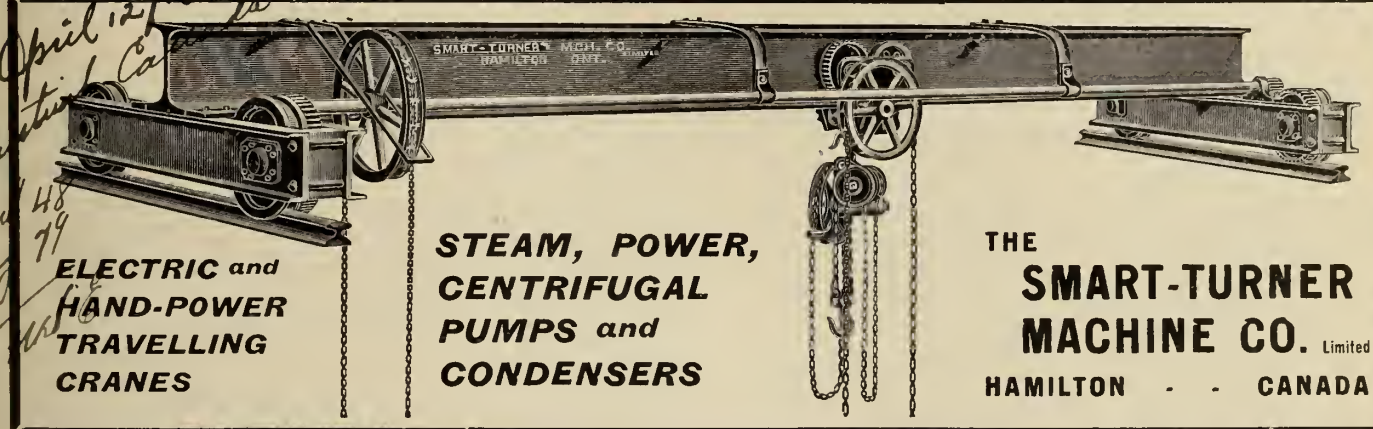

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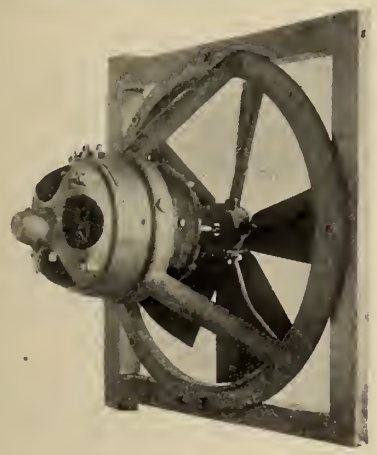

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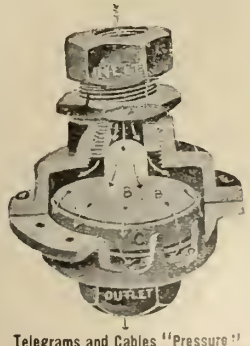

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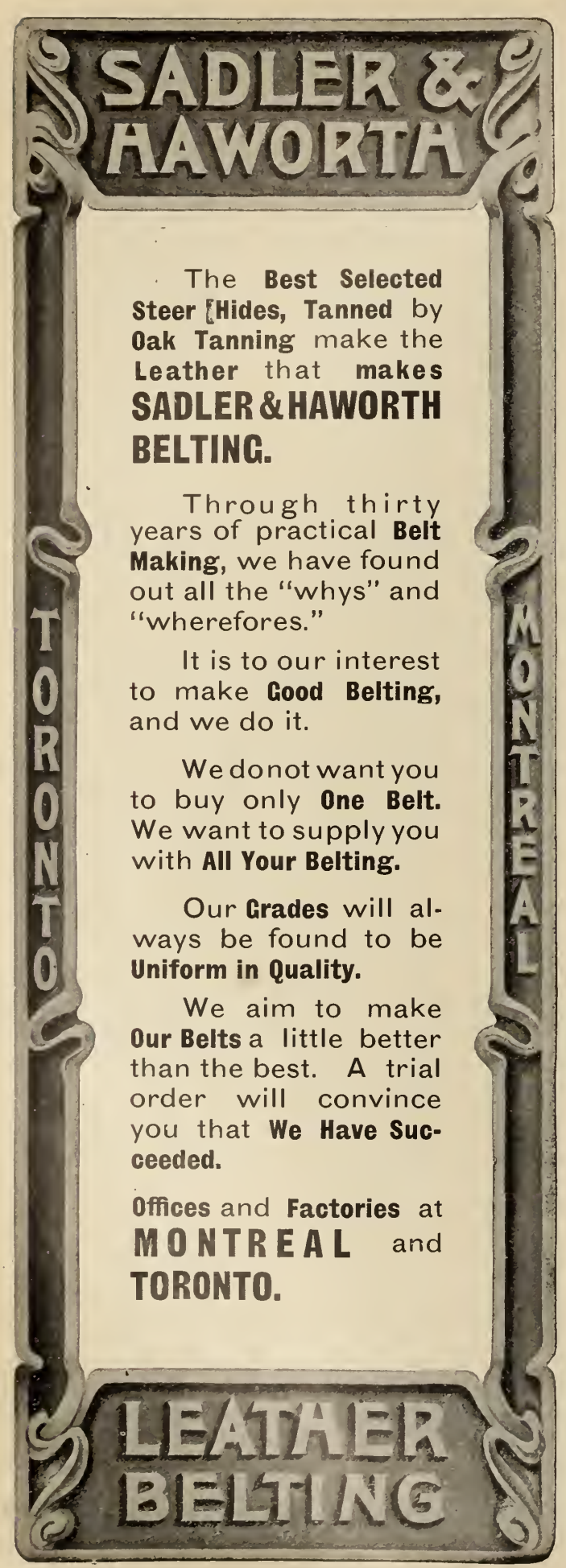
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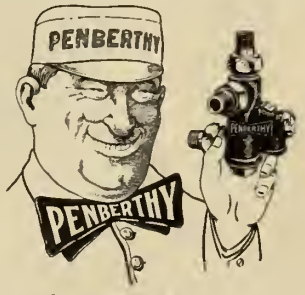

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A. B. Jardine & Co., Hespeler Ont.
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ALPHABETICAL INDEX.

A

Abbott, Wm. 71
Allis-Chalmers-Bullock Co. ..... Outside back cover
American Tool Works Co 13
Armstrong Bros. Tool Co. 78

B

Barnes, B. F., Co. 15
Banfield, W. H., & Sons 9
Becker-Brainard Milling Machine Co. 16
Berlin Electrical Mfg. Co. 69
Bertram, John, & Sons 16
Bickford Drill & Tool Co. 12
Bliss, E. W., Co. 77
Boynton & Plummer 9
Brandeis, Charles 65
Brown & Sharpe Mfg. Co. 72
Budden, Hanbury A. 65
Butterfield & Co. 74

C

Canada Foundry Co. 61
Canada Machinery Agency 8
Canadian Pneumatic Tool Co. 78
Canadian Press Clipping Bureau 65
Canada Chemical Mfg. Co. 5
Canadian Buffalo Forge Co. 7
Canadian Fairbanks Co. 20
Canadian Rand Drill Co. 79
Canadian Westinghouse Co. 1
Canadian White Co 79
Carr, John 63
Carter Publishing Co 67
Chadwick Bros. 70
Chapman Ball-Bearing Co. 11
Cincinnati Shaper Co. 15
Clark-Demill Co. 17
Cleveland Automatic Mach. Co. 15

D

David, R. Sullivan 71
DeCew, J. A. 67
Diamond Saw and Stamping Works 67
Dodge Mfg. Co 10
D'Olier Engineering Co. 4
Dominion Belting Co. 67
Dominion Rock Drill Co. 69
Dominion Sewer Pipe Co. inside back cover

E

Economical Mfg. and Supply Co 5
Electric Blue Print Co. 63
Engineering Specialties Co 63
Engineering Times 67
Expanded Metal and Fireproofing Co. 67

F

Fetherstonbaugh & Co. 65
Fetherstonbaugh & Blackmore 65
Fielding, John S. 65

G

Geometric Tool Co. 76
Globe Machine & Stamping Co. 67
Goldie & McCulloch Co. 1
Greening, B., Wire Co. 69

H

Hamilton Facing Mills Co 70
Hamilton Pattern Works 63

J

Jardine, A. B., & Co. 72
Jenckes Machine Co. 8
Jessop, Wm., & Sons 71

K

Ker & Goodwin 71
Kerr Turbine Co. 4

L

Laurie Engine Co. 4
Leonard, E., & Sons 69
Lewis, Rice & Son 77
Link-Belt Eng. Co 11
London Machine Tool Co. 12

M

McDougall, R., & Co. 69
McDougall, John, Caledonian Iron Wks 2
McEachern Heating & Ventilating Co. 8
McLachlan Gasoline Engine Co. 69
McLean & Sophus 76
Marion & Marion 65
Merrell Mfg. Co. 11
Morrow, John, Machine Screw Co. 73
Morton, B. K., & Co 71

N

National Machinery Co 69
New Process Twist Drill Co. 70
Nicholson File Co. 72
Nugent, Wm. W., & Co. 67

O

Otis-Fensom Elevator Co. inside back cover
Ottawa Steel Castings Co. 71

P

Packard Electric Co. 80
Parke, Roderick J. 65
Penberthy Injector Co. 67
Petrie, H. W. 14
Pilkington, Peter, Limited 9
Pratt & Whitney Co. ..... inside front cover
Pringle, T., & Son 65

R

Remington Typewriter Co. 60
Ridout & Maybee 65
Robb Engineering Co. 3
Rubbra, Alfred 63

S

Sadler & Haworth 66
Sells Commercial 70
Sheldon & Sheldon 6
Siegwartbeam Co 70
Smart-Turner Machine Co. 61
Standard Bolt and Screw Co 73
Standard Tool Co. 77
Standish, W. T. 9
Starrett, L. S., Co. 74
Stevens Co. of Galt 74
St. Lawrence Supply Co 73
Sturtevant, B. F., Co. 6
Spon & Chamberlain 72
Sylvester Mfg. Co. 5

T

Taylor & McKenzie 70
Technical Pub. Co. 80
Toronto and Hamilton Electric Co 79
Toronto Plate Glass Importing Co. 63

U

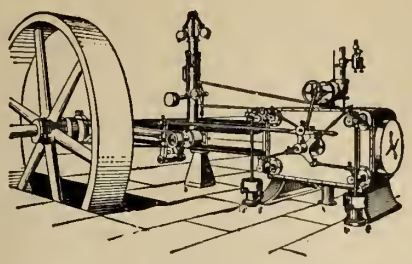
Underwood, H. B., & Co. 15
Union Drawn Steel Co 70
United Electric Co. ..... Inside back cover

V

Volta Electric Repair Works 79

W

Waterous Engine Works Co. 2
Wayland, Williams & Dadson 8
West Haven Mfg. Co. 73
Wells Pattern & Model Works 63
Williams & Wilson 18
Wilmarth & Morman 9
Whitman & Barnes 75



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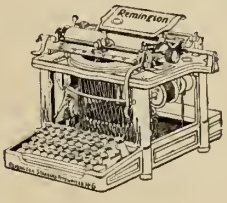

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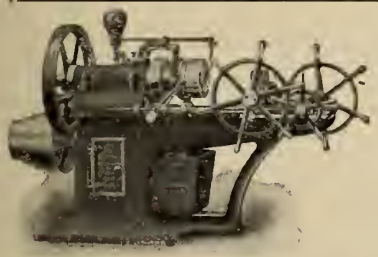

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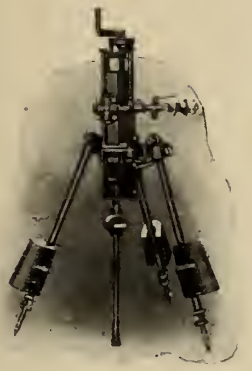

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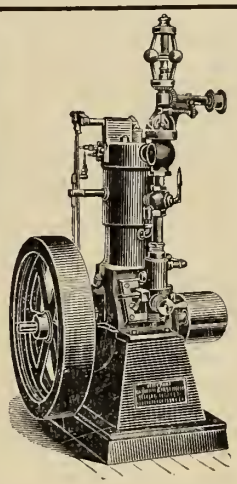

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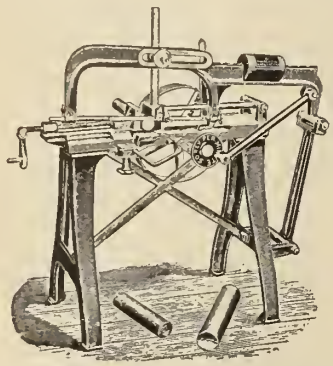

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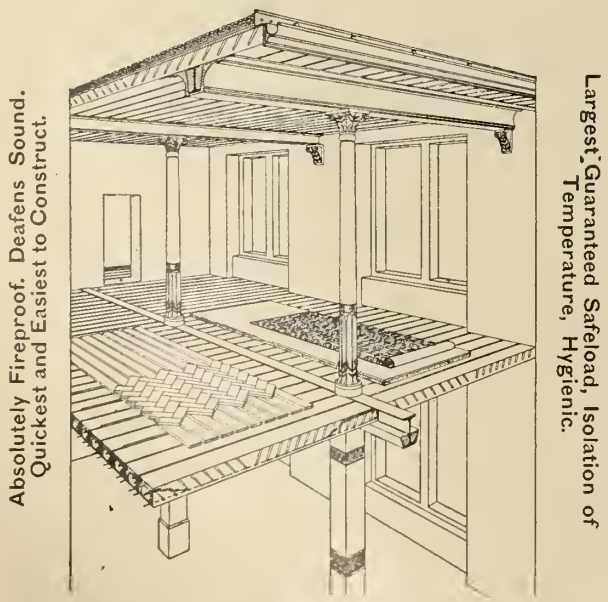

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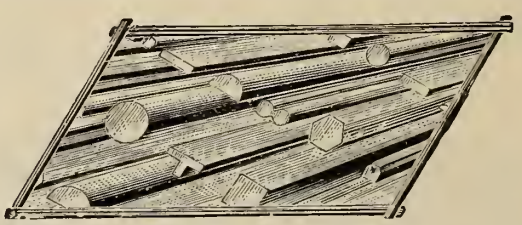

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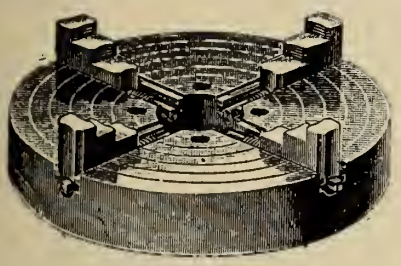

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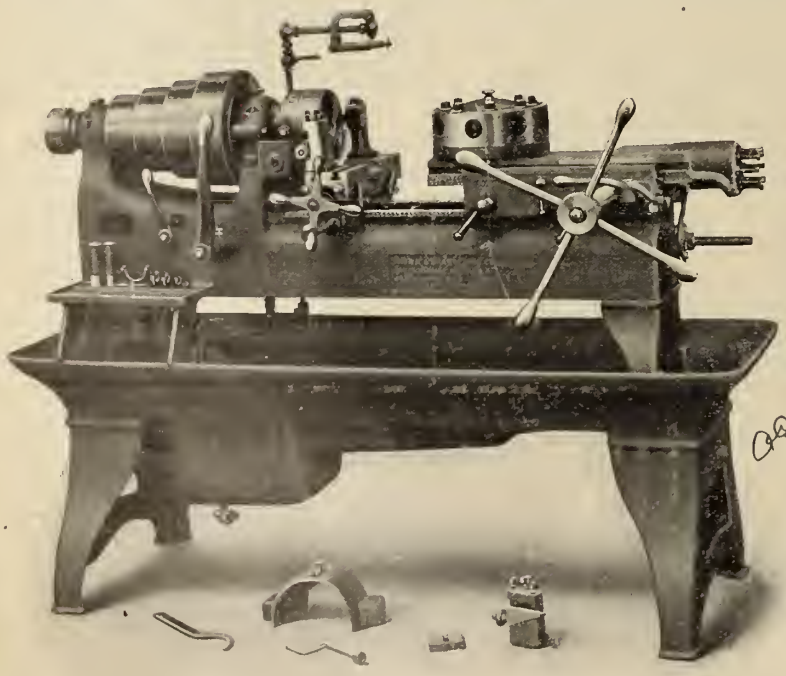

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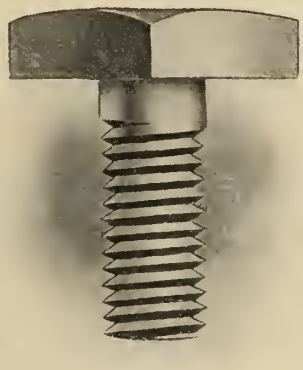

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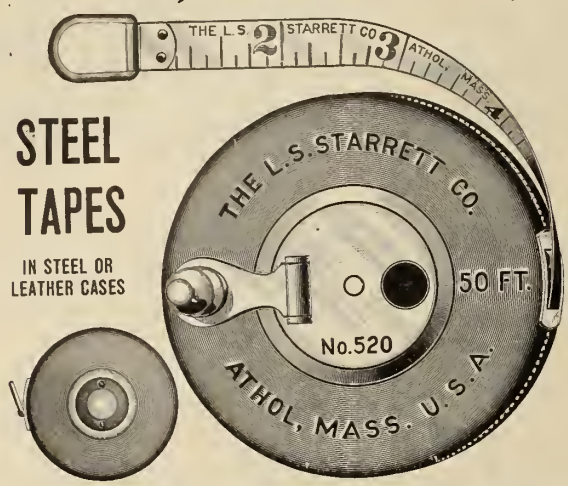

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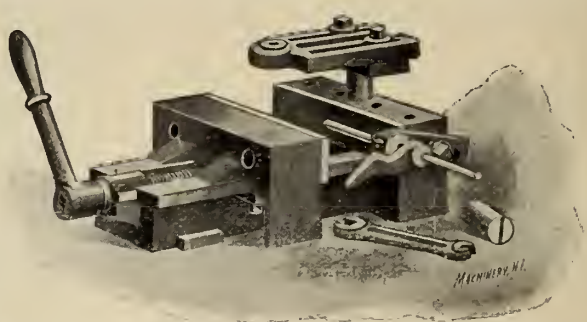

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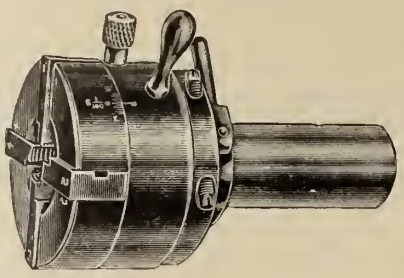

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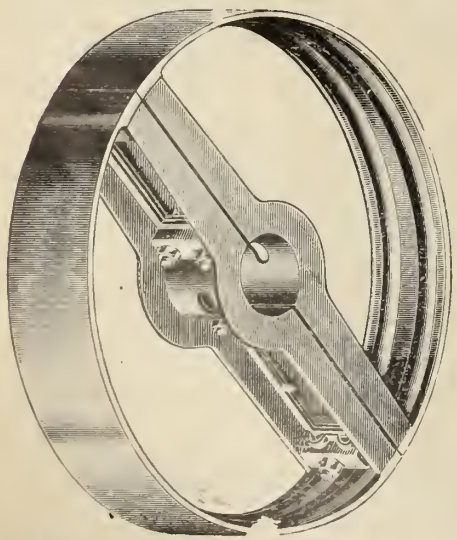

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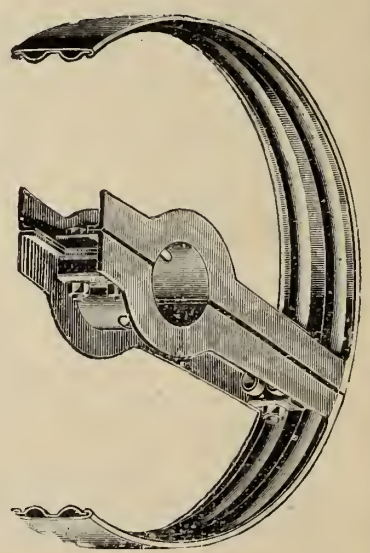

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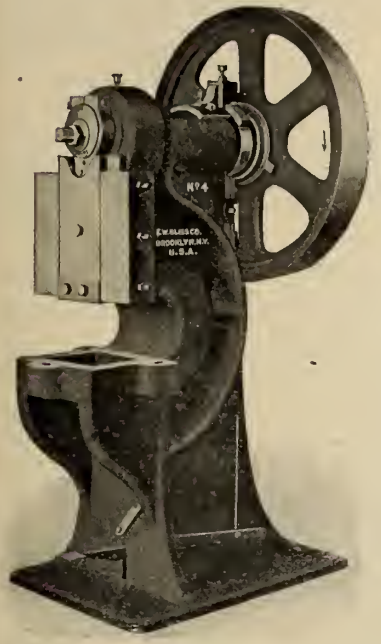

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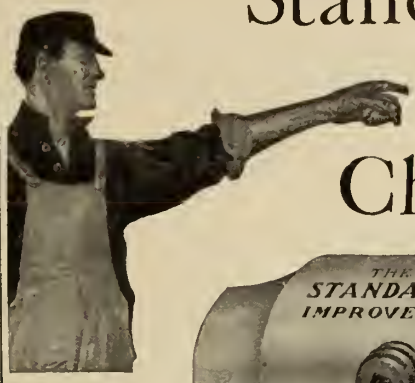

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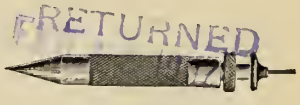

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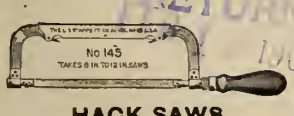

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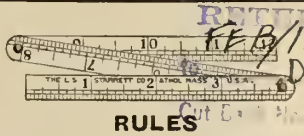

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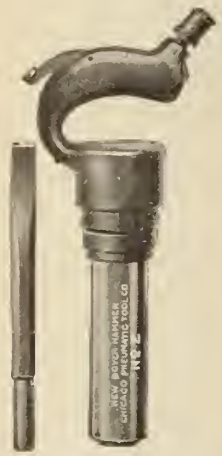

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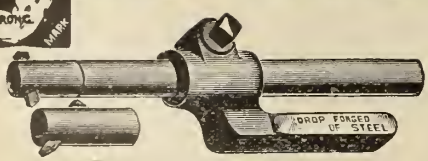

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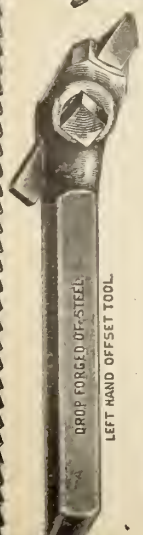

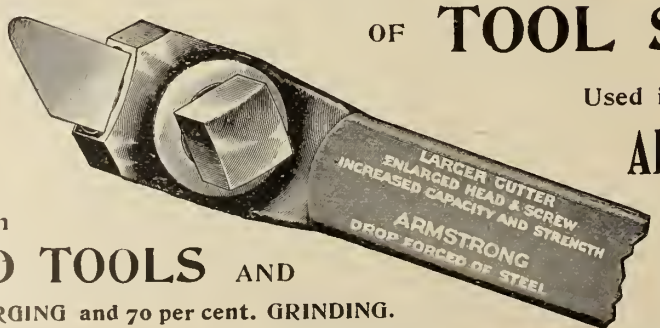

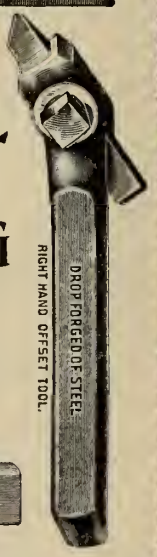

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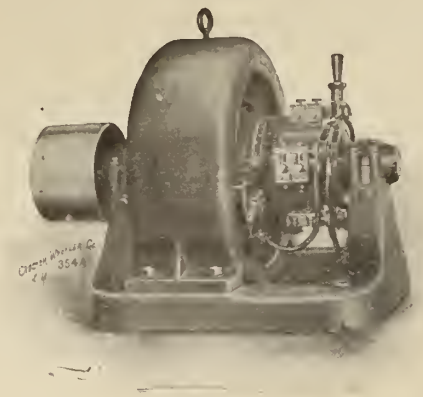

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Electric Light — and — Power Plants

Manufacturers of

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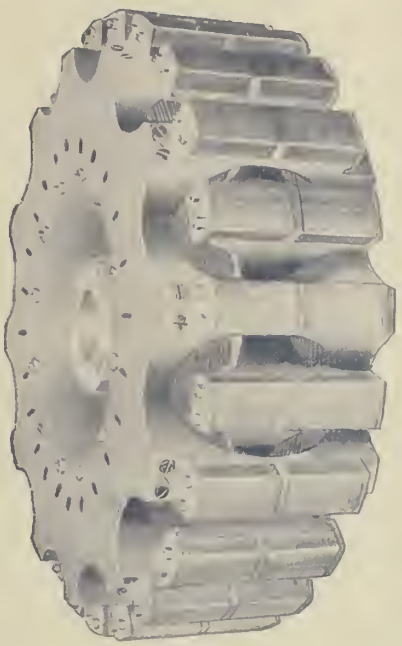
All sizes, frequencies and pressures.



Rotor for same.

The UNITED ELECTRIC COMPANY (LIMITED)

468-474 King Street West, TORONTO

Phone Number Parkdale 1809

Post Office and Telegraph Address Swansea

The Dominion Sewer Pipe Co., Limited

Swansea (near Toronto)

The season is near at hand when Sewer Pipes will be needed and from present indications there is going to be an enormous demand during 1906. Better place your orders early, so as to have the pipes on hand when your trade requires them.

VITRIFIED SALT GLAZED SEWER PIPES

in sizes from 4 inches to 24 inches. Price lists and discounts on application.

The Dominion Sewer Pipe Co., Limited

Works : Swansea, Toronto, Ont.

OTIS ELEVATORS

FOR ALL DUTIES

Electric, Hydraulic, Belt, Steam and Hand Power

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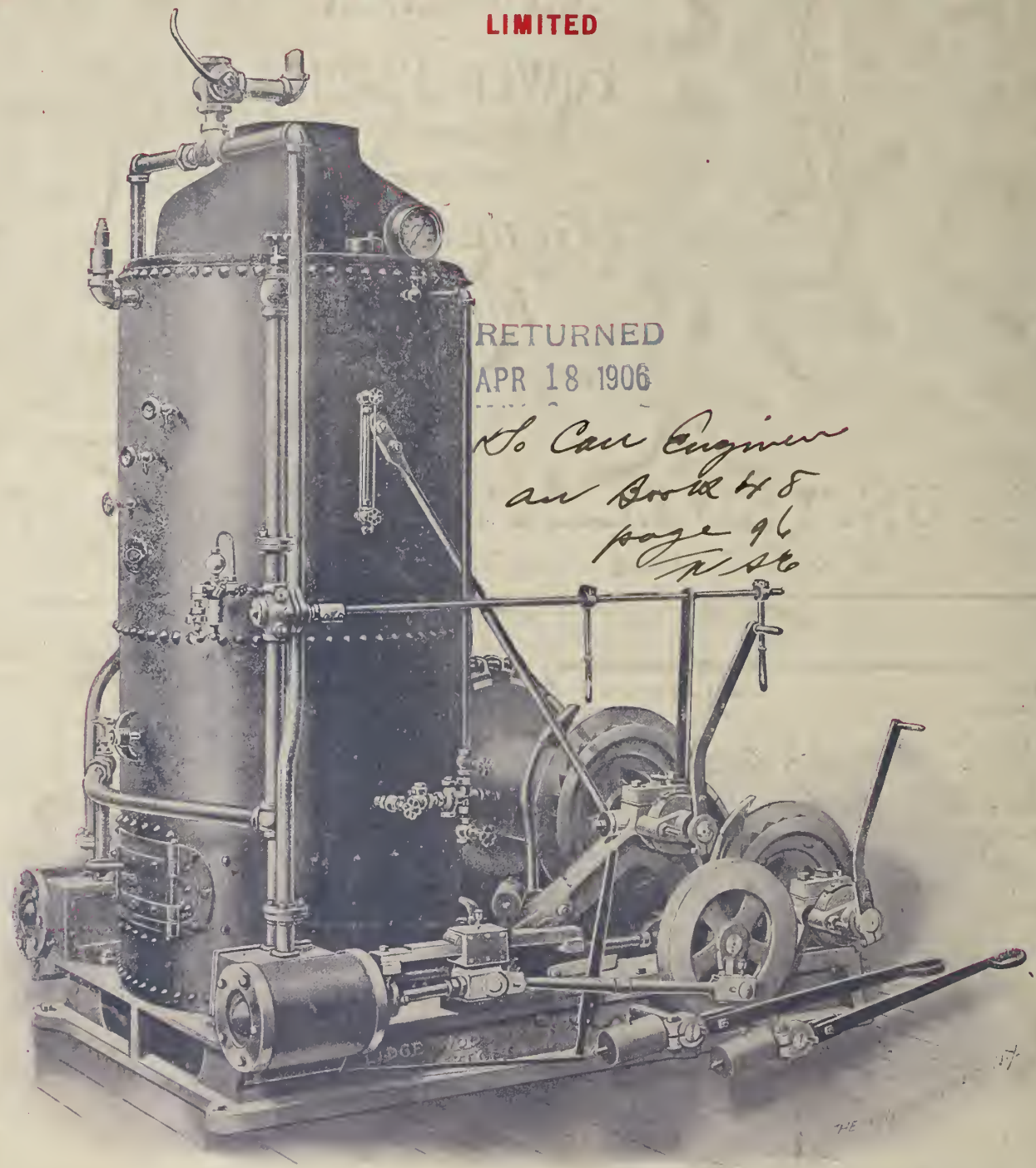

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No Can Engines
on Book H 8
page 96
N 86

Double Cylinder, Double Friction Drum Hoisting Engine.

ONE OF MANY PRODUCTS

This hoisting engine, with boiler and fixtures, ratchets and pawls complete, is especially adapted for pile driving, dock and bridge building, quarries, railroads, and general derrick work.

Works: MONTREAL. Branch Offices: NEW GLASGOW, TORONTO WINNIPEG, NELSON AND VANCOUVER

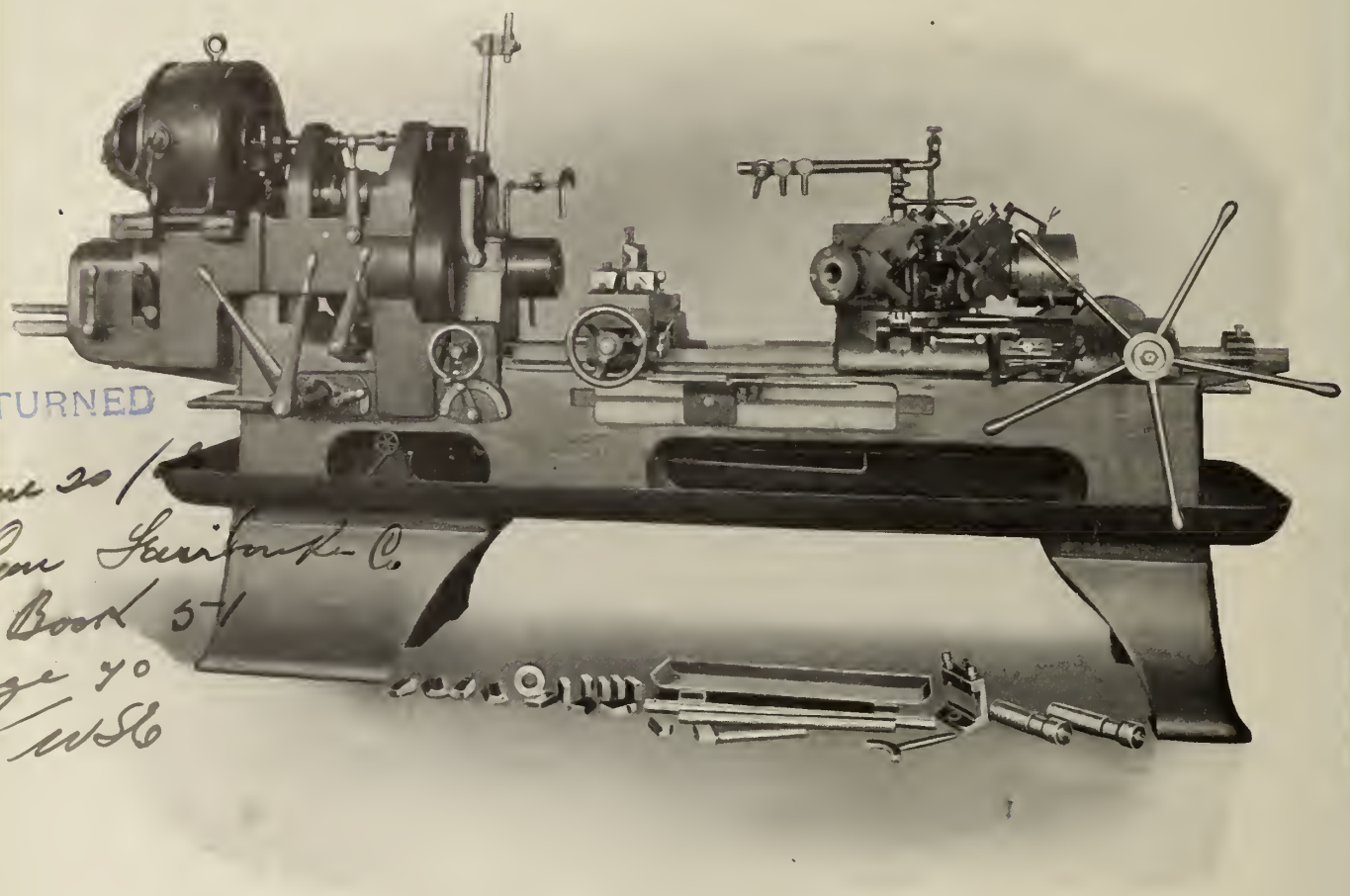
CANADIAN MACHINERY

AND MANUFACTURING NEWS

MAY

TURRET LATHES

FIVE SIZES, $\frac{3}{8}$ x $4\frac{1}{2}$-inch, 1 x 10-inch, $1\frac{1}{2}$ x 18-inch, 2 x 26-inch, 3 x 36-inch



RETURNED
June 20/
T. Can Fairbanks Co.
Cat Book 57
page 70
W56

3 x 36-inch Pratt & Whitney Turret Lathe, driven 5 h.p. motor.

The motor drives through a speed-box which, with the double friction back-gears, affords a wide range of speeds.

Cross and longitudinal power feeds are positive geared, reversible, and have automatic stops in either direction.

The cross slide permits the use of larger forming tools than can be held in a turret and makes possible the use of three turret tools at one time.

Pratt & Whitney Company

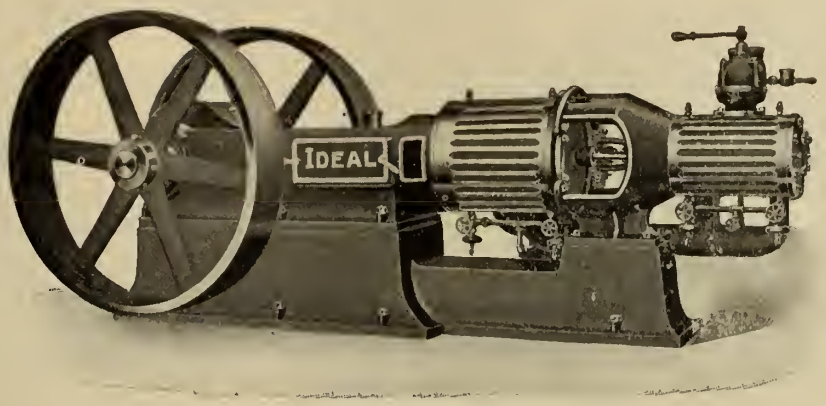
WORKS:—HARTFORD, CONN., U.S.A.

THE CANADIAN FAIRBANKS CO., Agents for Canada.

MONTREAL ***TORONTO*** ***WINNIPEG*** ***VANCOUVER***

IDEAL ENGINES

Perfection in High Speed Engine Design. Noiseless Running—Perfect Lubrication—Accessibility—Economy



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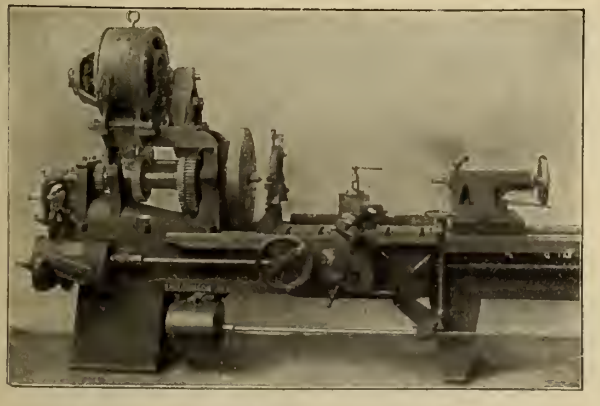
THE GOLDIE & McCULLOCH CO., LIMITED

GALT — ONTARIO — CANADA

WE MAKE Wheelock Engines, Corliss Engines, Ideal High Speed Engines, Boilers, Pumps, Flour Mill Machinery, Oatmeal Mill Machinery, Wolf Gyrators, Emery Choppers, Woodworking Machinery, Shingle Machinery, Heading and Stave Machinery, Wood Rim Split Pulleys, Iron Pulleys, Shafting, Hangers, Friction Clutch Couplings, Friction Clutch Pulleys, Safes, Vaults, Vault Doors.

Westinghouse Motors



Westinghouse Type S. Motor Driving Johnson, Jr., Lathe

Increase Production Decrease Costs

Overtime work is necessary in almost all machine-shops. With individually driven tools this work is done at a minimum cost, only the electric energy to operate the driving motor being required.

Canadian Westinghouse Co., Limited

General Office and Works, HAMILTON, ONTARIO

Lawlor Bldg., King and Yonge Sts.
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For Particulars Address Nearest Office
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MONTREAL

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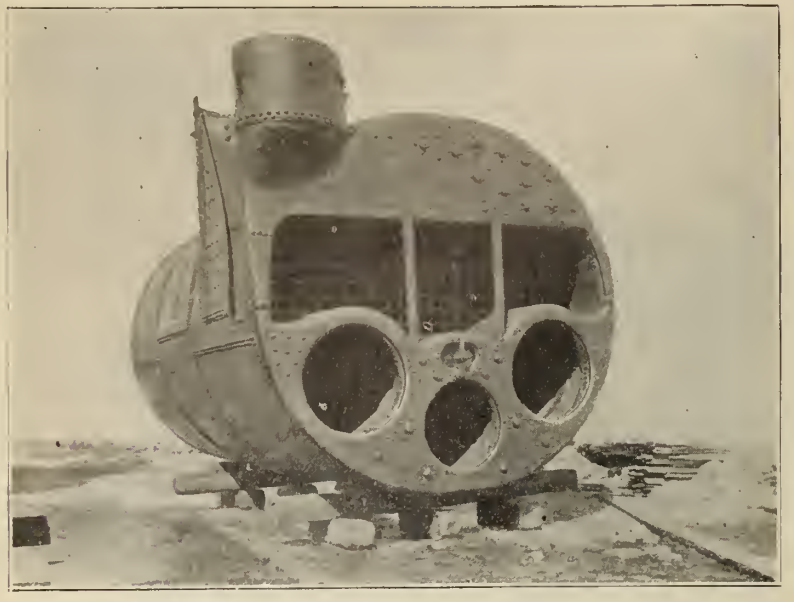
HALIFAX

Boilers for All Services



One of two Marine Boilers built in our shops for the Richelieu & Ontario Navigation Co.'s Steamer "Carolina." Length 21', diameter 13' 4", weight 38 tons.

Return Tubular,
"McDougall" Water Tube,
Marine, Lancashire,
Etc.

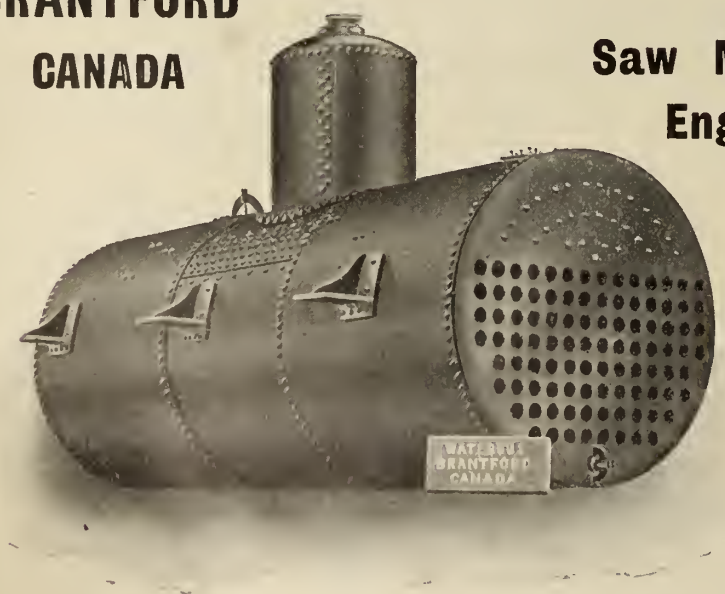
Penstocks, Tanks,
Grain Hoppers, Spouts,
Cement Machinery

The John McDougall Caledonian Iron Works Co., Limited

MONTREAL

WATEROUS ENGINE WORKS CO., Limited

BRANTFORD
CANADA



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Saw Mill and Pulp Mill Machinery
Engines, Boilers, Fire Apparatus
Brick Machinery, Elevator
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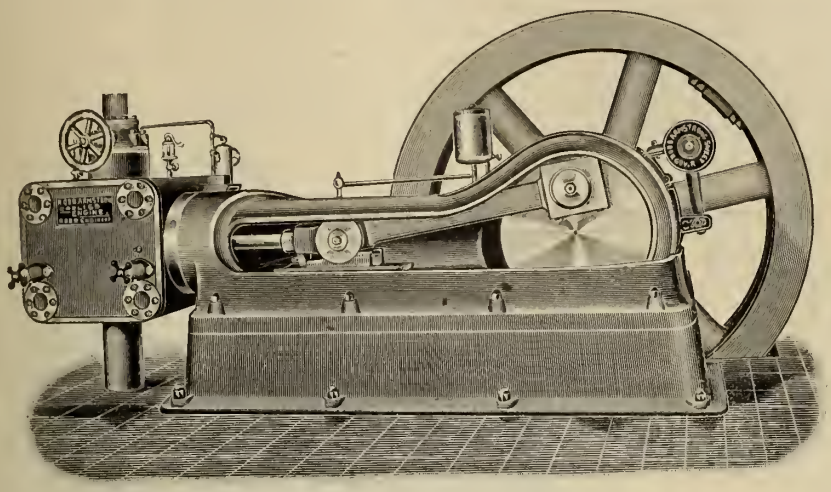
Conveyor Machinery,
Chain, Belting, etc.

WRITE US for FULL Particulars, Prices and Catalogues.

A FINE STEAM PLANT



"I will say without qualification that it is as fine a boiler and engine plant as I have ever had the pleasure of seeing for its size. The engine was working without heating and absolutely without any noise I wish to congratulate you on your success in building this class of engine, and hope that we may have pleasure in dealing with you again."

The above refers to a 350 horse power Robb-Armstrong Corliss engine and two 175 horse power Robb-Mumford boilers installed by us.

Robb Engineering Co., Ltd., Amherst, N.S.

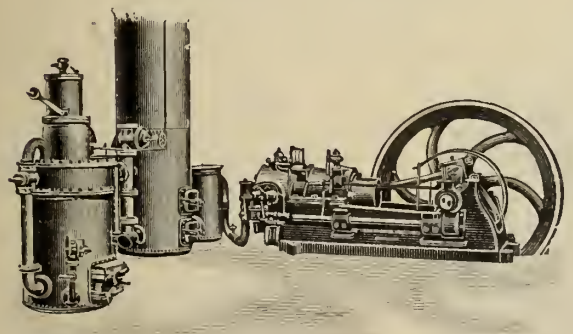
DISTRICT OFFICES { 320 Ossington Avenue, TORONTO; Wm. McKay, Manager.
Bell Telephone Building, MONTREAL; Watson Jack, Manager.
355 Carlton, Street, WINNIPEG ; J. F. Porter, Manager.

"CAMPBELL"

SUCTION GAS POWER PLANTS

OPERATE ON A

Guaranteed consumption of Anthracite Coal of 3/4 to 1-lb. per B.H.P. per hour according to size.



Many of these Plants in operation in Montreal and vicinity.

35 H.P. in Stock for Immediate Delivery.

Wayland Williams & Dadson
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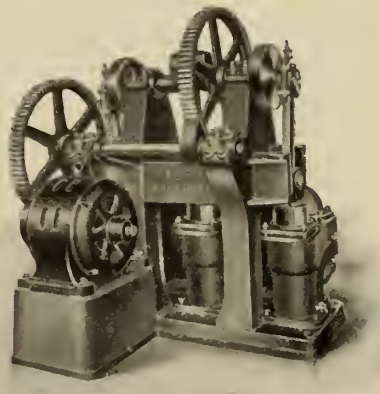
TRIPLEX POWER PUMPS



SINGLE AND DOUBLE ACTING.
ANY STYLE DRIVE. FOR ALL PURPOSES.

LAURIE ENGINE AND MACHINE CO., LTD.
MONTREAL, - CANADA

Sylvester Gasoline Engines

Are the best that skilled labor can produce.

They are easy starting; they are simple and reliable; they will give full power in the coldest weather. Made in sizes from 4 to 32 horse power in portable snd stationary and from 1½ to 12 horse power in marine. They will run on gasoline, coal oil or distillates.

The SYLVESTER Engine inspires confidence because it is so simple in construction. It is the cheapest engine to buy because there is nothing to get out of order.

The SYLVESTER Engine is handsome in appearance, substantial in construction, marvelous in simplicity, unequalled for effectiveness and durability.

THE HIGHEST AND MOST PERFECT TYPE OF GASOLINE ENGINE BUILT.

If you require to purchase, write for Catalogue and our 1906 Calendar. We will then send our Travelling Salesman to you

THE SYLVESTER MFG. CO., Limited, - - LINDSAY, ONT.

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AN ILLUSTRATED WEEKLY JOURNAL

Edited by WILLIAM H. MAW and JAMES DREDGE

PRICE SIXPENCE.

"ENGINEERING," besides a great variety of Illustrated Articles relating to Civil, Mechanical, Electrical and Military Engineering and Notes of General Professional Interest, devotes a considerable space in each issue to the illustration and description of all matters connected with the PRACTICAL APPLICATION OF PHYSICAL SCIENCE, and with its Wide and Influential Circulation in all parts of the world, this Journal is an

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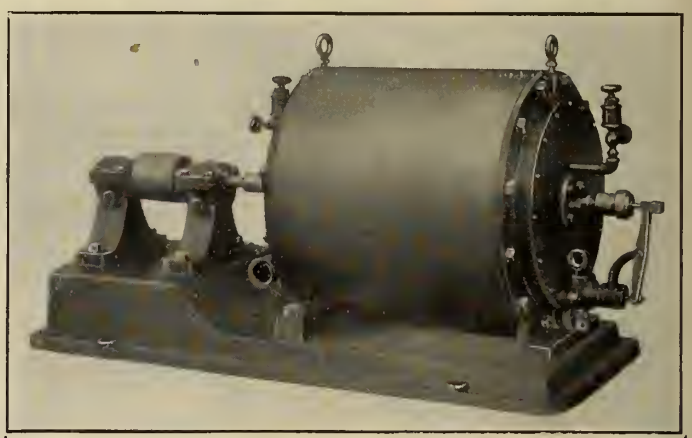

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For general service in factories, power plants and public buildings.

Condensing or non-condensing. Exhaust at any back pressure for steam heating. Direct coupled without gears to generators, centrifugal pumps and blowers.

Horse power 5 to 1000. Regulation close. Steam economy excellent and not changed by wear. No clearance and leakage troubles. Flooded lubrication of bearings without oil in the exhaust. No danger from water entrained with steam. High vacuum not necessary. Good results with ordinary jet and surface condensers. *Bulletin on request.*

Main Office and Works:

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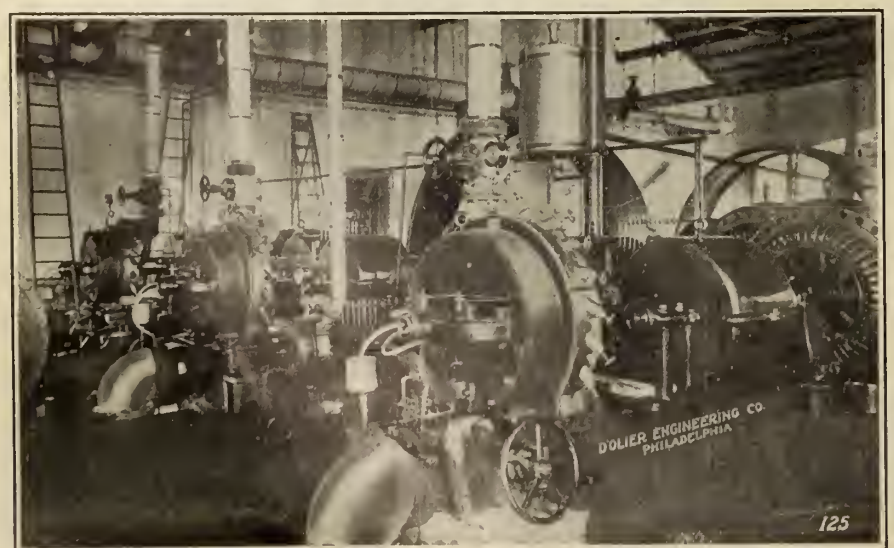
Built in Canada by

WM. STEPHENSON

34 Bay Street N. ***HAMILTON, ONT.***



3-200 KW DeLaval Steam Turbine Alternators Installed at Jacksonville, Fla., U.S.A., Municipal Plant.

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Turbine Motors
Turbine Dynamos
Turbine Pumps

Highest Efficiency. ***Long Life.***

D'Olier Engineering Co.

74 CORTLANDT STREET, NEW YORK, U.S.A.

"I Would Say to Steam-Users:

'If you want to save coal, if you want to save repair bills, if you want to prevent shut-downs, if you want to lengthen the life of your boilers, if you want to increase their efficiency—then ***Scale Formation*** must be prevented.'"

TRI-SODIUM PHOSPHATE

Keeps Boilers Clean and Free from Scale

For complete information about ***T. S. P.*** write to

THE CANADA CHEMICAL MANUFACTURING CO., LIMITED

London ***Canada***

A Post Card Will Do

Have you read the story of Canada's New Lubricating Graphite? This wonderful discovery is a money saver. It prevents hot boxes and pins, groaning cylinders, etc. It reduces oil and grease consumption by one-fourth. It increases the compression of Gas and Gasoline Engines. It remains suspended in oil and will feed through any lubricator. A little does the work. This knowledge means money in your pocket. **A POST CARD WILL FETCH YOU THE STORY AND A SAMPLE PACKAGE. WRITE TO-DAY.**

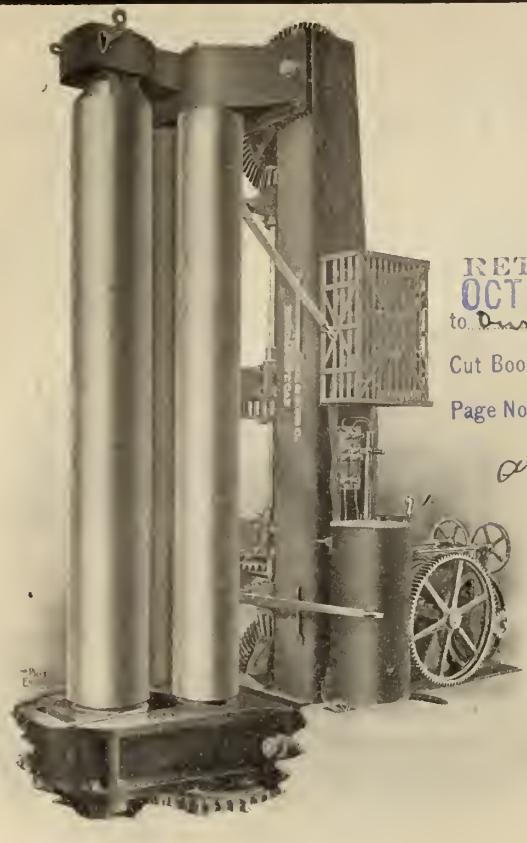
The Economical Mfg. and Supply Co.

LIMITED

171 QUEEN STREET EAST, TORONTO, CANADA

Manufacturers and Dealers in Power Users' Supplies

Canadian Agents for the New York Belting & Packing Co., Limited



RETURNED
OCT 8 - 1906
to Dunn
Cut Book No. 55
Page No. 93

Vertical Bending Rolls

This machine is built in two sizes, for plates 10 feet wide and 1½ inches thick; 12 feet wide and 1¼ inches thick. The rolls are arranged in pyramid form and the two fixed rolls are positively driven in either direction. The bending roll is adjustable by power and provided with suitable indicator to facilitate the setting. The upper bearing of bending roll is so arranged as to be thrown back to permit the roll being raised clear of the housing for the removal of rings or flues. The gearing is placed beneath the floor and is driven by 50 H.P. reversing motor.

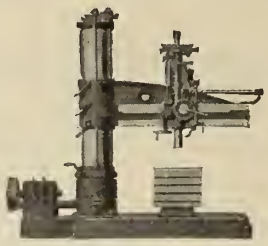
The John Bertram & Sons Co., Limited

Dundas, Ontario, Canada

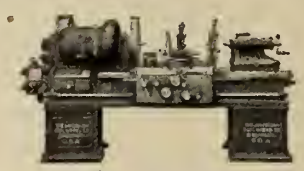
MODERN MACHINE TOOLS

WITH BELT OR MOTOR DRIVE

14 in. to 62 in. Swing.
With "Quick Change Gear Mechanism.



2½ ft. to 7 ft Arm.
Driven through Speed Box or Cone.



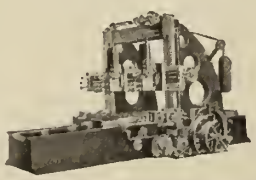
14 in. to 62 in. Swing.
"Patented" Geared Head (Single Pulley Drive.)

20 in. to 24 in. Swing.
Strong and Accurate.

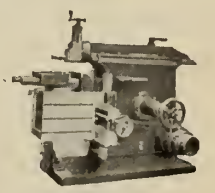
Write direct, or to

H. W. PETRIE, MONTREAL

A. R. WILLIAMS MACH'Y CO., TORONTO



22 in. to 72 in. between Housings.
Single or Variable Speed.

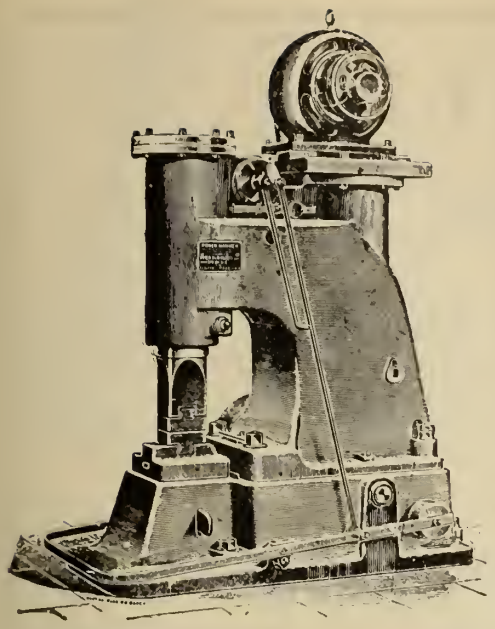


16 in. to 28 in. Stroke.
Highly Geared.

25 in. to 36 in. Swing.
With Geared Feed.

THE AMERICAN TOOL WORKS CO.,

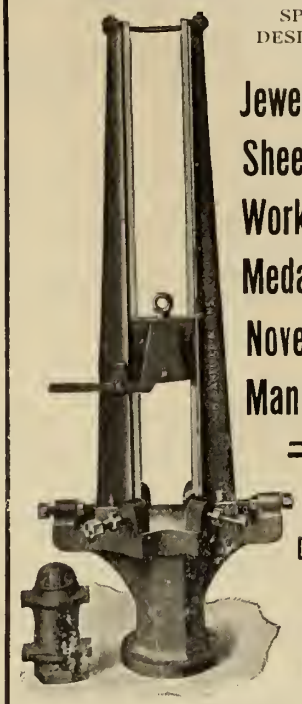
Cincinnati, U.S.A.



Pilkington's Power Hammers

Driven by Electric Motor or from Line Shaft
Used by all the Principal Engineering and Shipbuilding Works, Railway Companies, Mines, etc.
ALSO NEW COMPRESSED AIR HAMMERS
Worked from Separate Compressor.
We can save you over 50 per cent. in power consumption as compared with other types.
These Hammers have Compound Cylinders and require a surprisingly small quantity of air.
HAVE YOU STEAM HAMMERS?
We can convert them to our new type AIR HAMMERS.
Send for "H" List
PETER PILKINGTON, LTD., 75a, QUEEN VICTORIA ST., LONDON, E.C.

DROP PRESS



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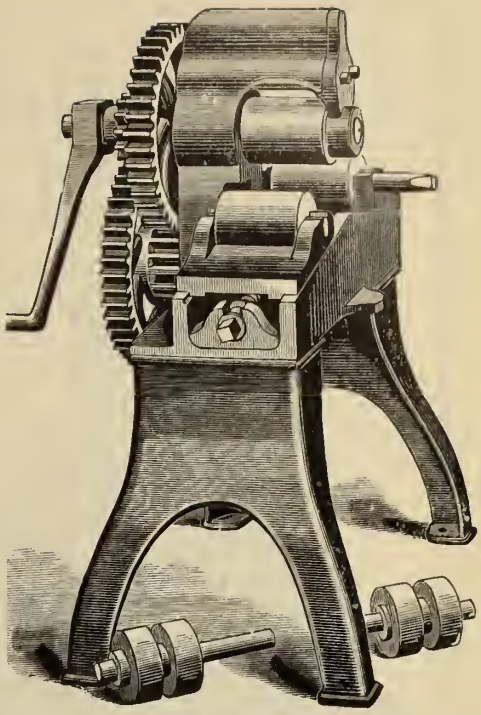
WRITE FOR PRICES ON

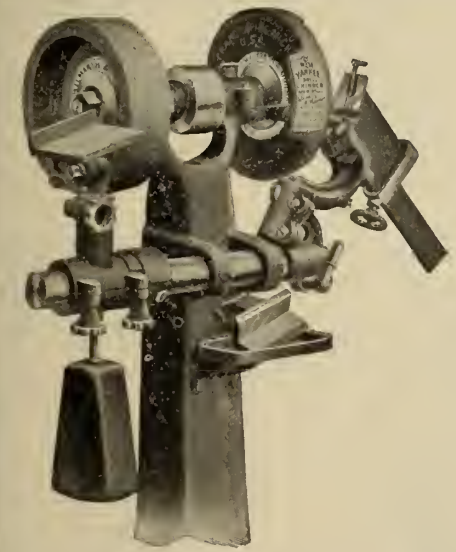
DIES, TOOLS, AND SPECIAL MACHINERY

W. H. BANFIELD & SONS
120 Adelaide Street West, TORONTO.



Our ***No. 1 TIRE BENDER*** is made with open side so that tires can be taken out without springing. The ends of tires coming through the rolls are sure to come together perfectly square. Grooved rolls for bending iron edgewise, furnished when ordered. Tight and loose pulleys fitted for power when desired. Will bend tires up to 7/8 in. thick by 5 wide.

BOYNTON & PLUMMER, WORCESTER, MASS., U. S. A.

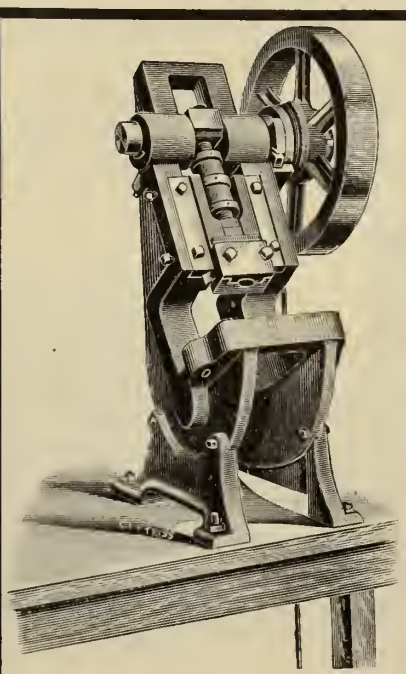


Besides Grinding Drills This Machine Will Do a Thousand and One Jobs

grinding that cannot so well nor so cheaply be done in any other way. That accounts for the large number sold. It makes every drill in your shop do ***more*** and ***better*** work, and do it ***quicker,*** and then, you know, a ***properly*** ground drill is hard to break.

Incidentally, every hole you drill is made ***cheaper*** and ***better to size,*** and we'll leave you to judge what that's worth to you, in your shop. We have printed matter that explains more fully than space permits here. May we send it?

WILMARTH & MORMAN CO.
577 Canal Street, - Grand Rapids, Mich.



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Canadian Made

ALL SIZES

For Stamping of all kinds

Equipped with instantaneous four-point clutch

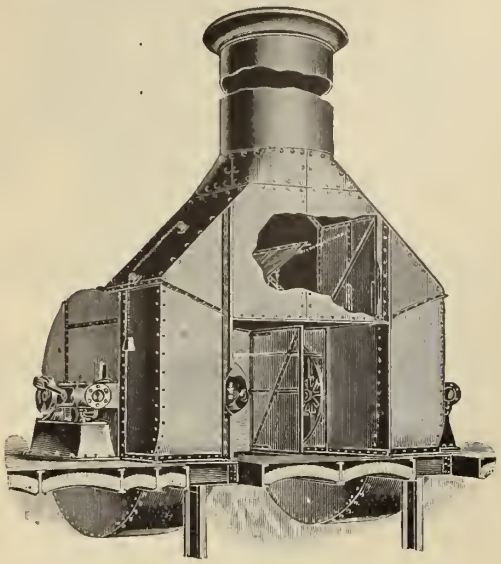
Also Tinsmiths', Cornice Makers', Metal Workers' and Canners' Machinery.

Manufactured by

Brown, Boggs & Co., Limited

Special Representative:
W. T. STANDISH, - - Toronto

Fans and Blowers for Induced and Forced Draft



Drying Systems of all kinds for drying any material.

Shavings Exhaust Systems installed complete.

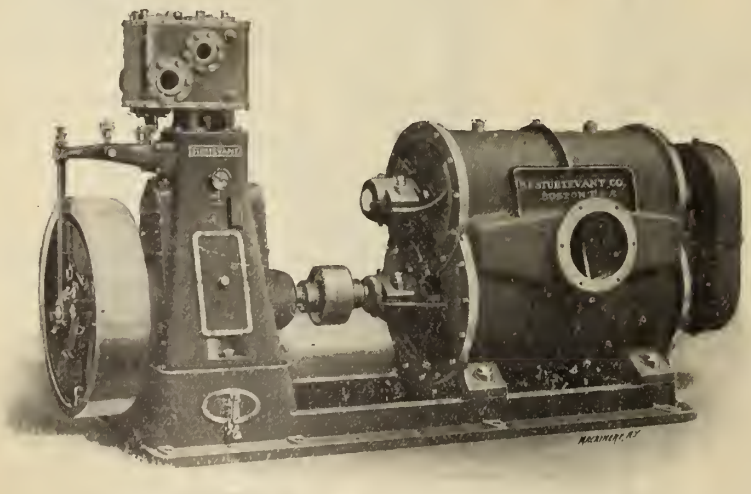
Dry Kiln Trucks and Wheels, Lumber Dryers, Brick Dryers, Steel Brick Cars, Transfer Cars, Turntables, etc.

Stationary and Portable Forges, Cupola Blowers, Exhaust Fans, Planing Mill Exhausters, Dust and Shavings Collectors, and Steam Specialties such as Back Pressure Valves, Oil Separators, Exhaust Heads, etc.

Vertical and Horizontal Steam Engines.

SHELDONS LIMITED, Engineers and Manufacturers
GALT, - Ontario

IN THE STURTEVANT HIGH-PRESSURE BLOWER



The power is transmitted through the engine shaft to the single impeller. The idler driven by the gearing requires no power because it does no work.

Send at once for Bulletin No. 127.

B. F. STURTEVANT CO., Boston, Mass.

General Office and Works, Hyde Park, Mass,

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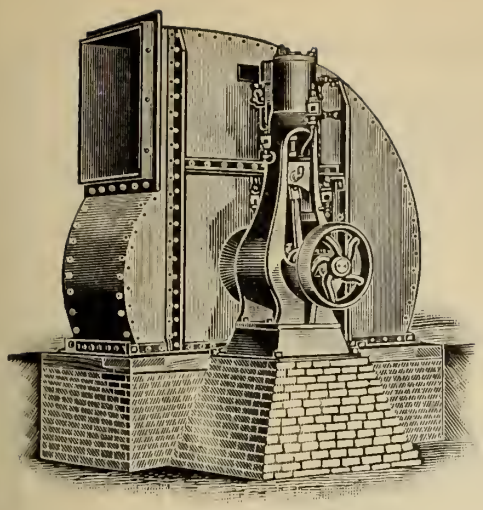

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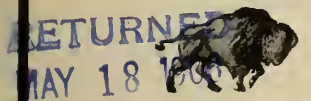

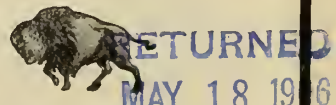

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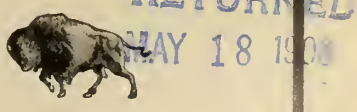

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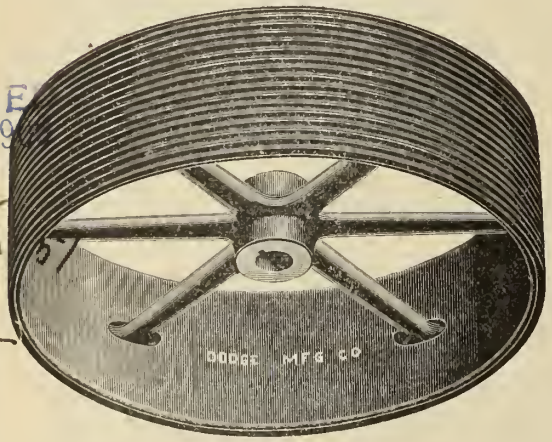

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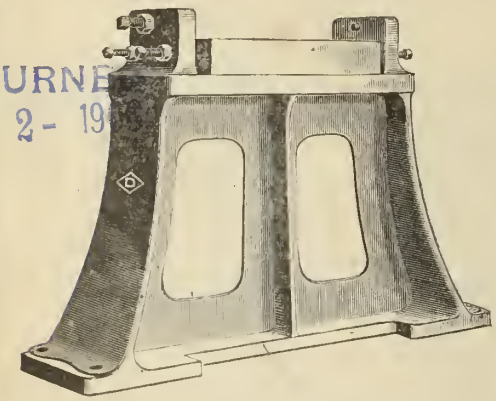

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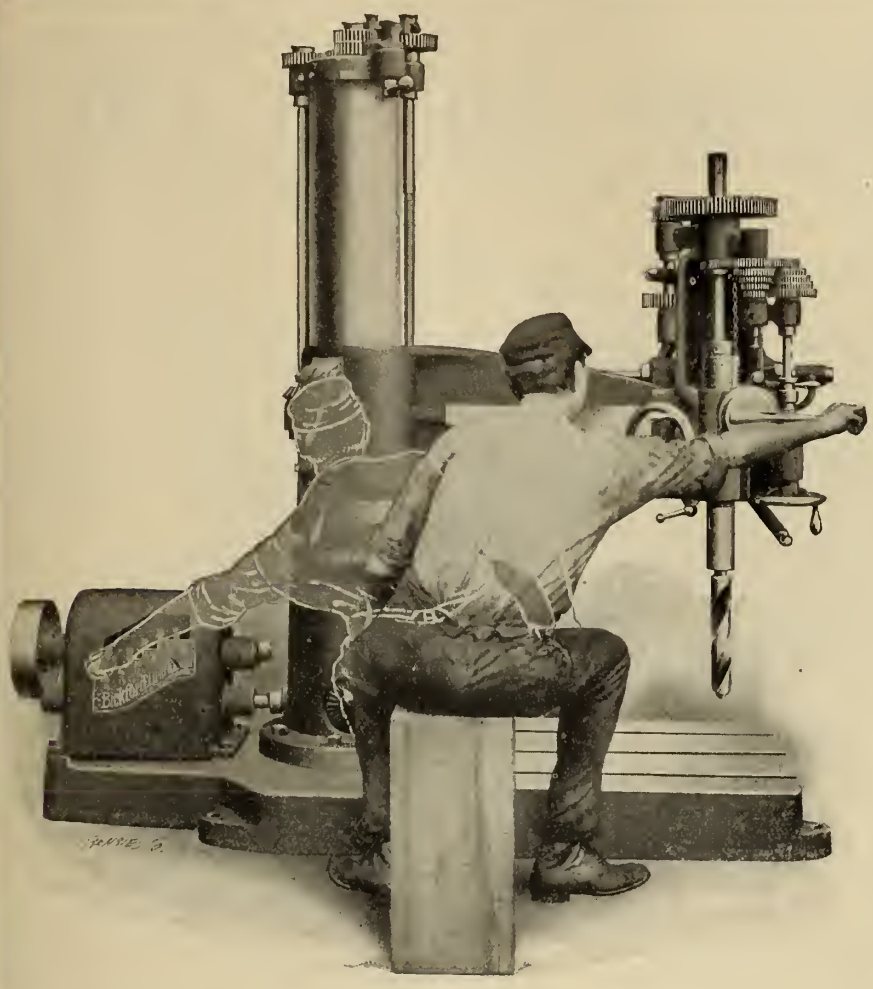

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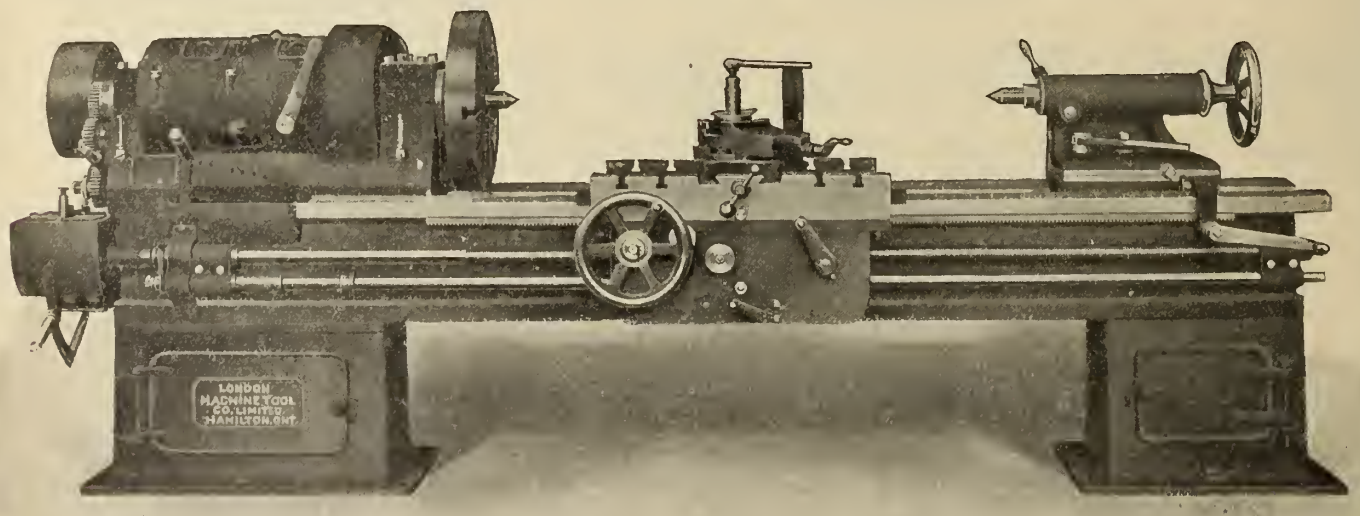

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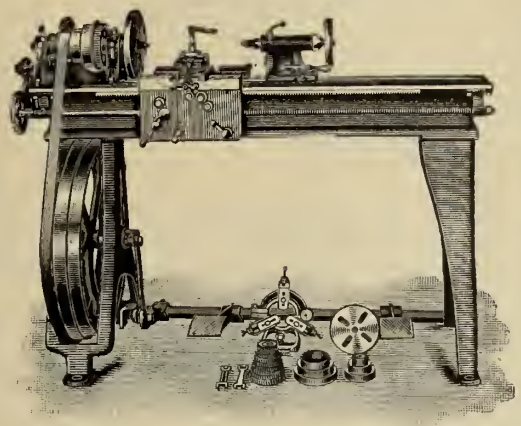

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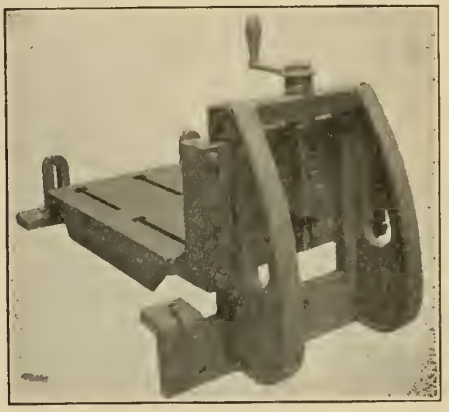

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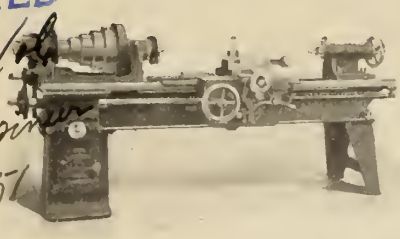

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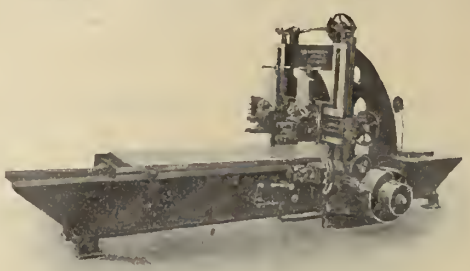

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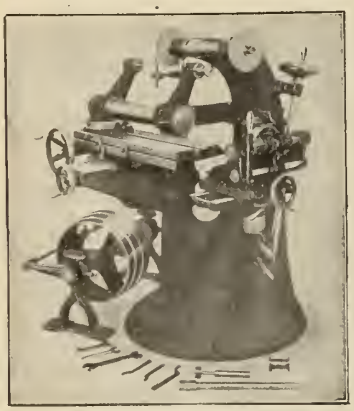

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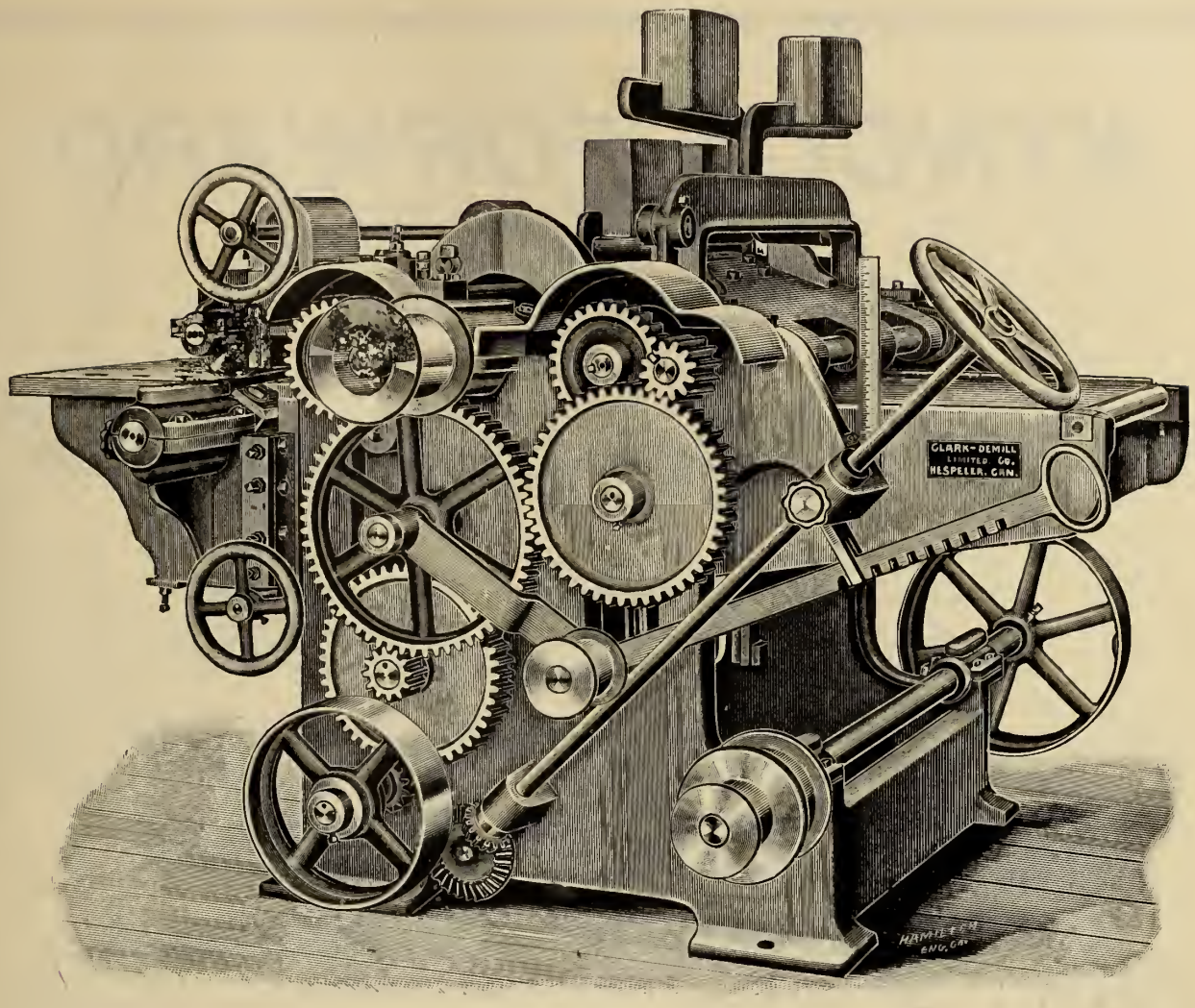

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If this machine is not heavy enough for you, why, we make heavier, and will be pleased to tell you about them.

All work guaranteed to be of the highest order.

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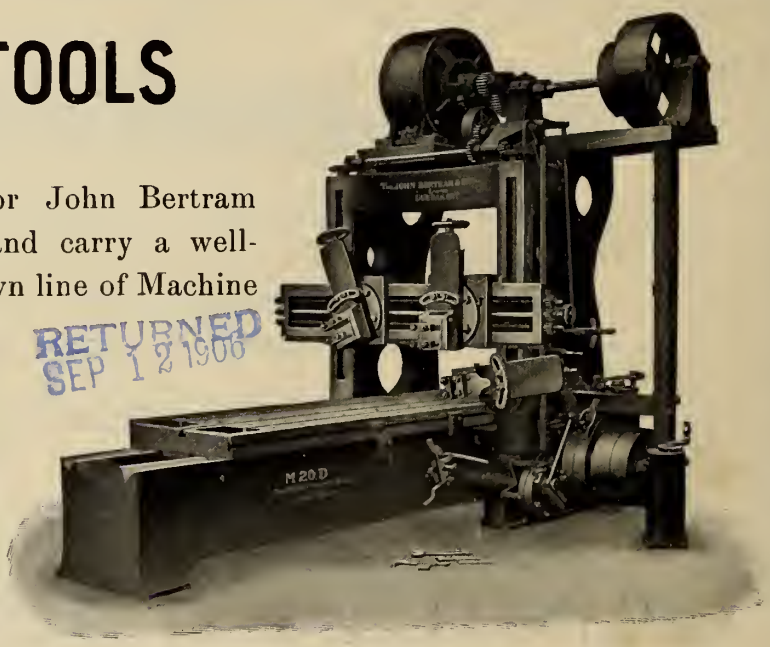

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Modern Canadian Manufacturing Plants.

ARTICLE XV.—New Foundry, John Bertram & Sons, Limited, Dundas, Ont.

WHEN the general public had been made cognizant of the fact that additional strength and larger interests had become associated with the firm of John Bertram & Sons, Limited, Dundas, plans were already well under way for extensive additions to the works part of which are exemplified in the new foundry. This building is but part of a general scheme, the main features of which have already been planned by the engineers of the firm, and which when carried out in full will make the Bertram works one of the largest manufacturing concerns in the Dominion. Less than a year ago the spot where the foundry is now situated was occupied by a beautiful residence with attractive grounds surrounded by a magnificent row of maples.

Manufacturing demands cannot consider the aesthetic, however, and these have disappeared to give way to a hive of industry, making employment for a larger number of men than were formerly needed, increasing the town's population, adding to land values and becoming a point of material production.

The location of this building is at considerable distance from the present machine shops, making ample allowance for their extension. Everything about it, both in its construction and equipment, is the latest and best that modern materials and methods could suggest, so that while there are many larger foundry buildings there is probably not one superior on the American continent. The material used both for the structural work and for the inside arrangement and devices is in all instances, where at all possible, of Canadian origin.

New Foundry, John Bertram & Sons, Limited, Dundas.—East Wing, Looking North.

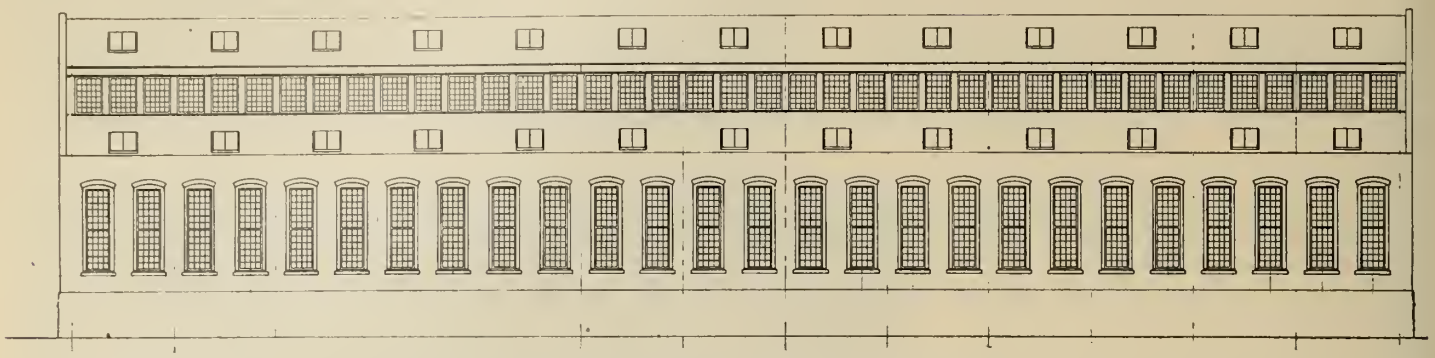
The Foundry Building.

Situated at the northeast corner of the block of land containing the Bertram premises, the foundry is probably the most easy of access for outside transportation of any of the buildings in the works. The structure itself is of brick on concrete foundations, which extend downwards of sufficient depth to give ample depth allowance for the molding floors. The frame work is of steel, furnished by the Phoenix Bridge Works, of Montreal. Work was commenced on Oct. 1, the contract being in the hands of Haney & Miller, of Toronto, and owing to the comparatively open Winter excelent progress was made, so that now the building is fully completed and ready to carry on extensive operations. The size of the building is 210 feet by 109 feet inside measurement, and is, as will be seen from the illustration showing the end views, divided into three sections or bays. The main central section being 52 feet in width to allow 50 feet clear span for crane, which latter is situated 20 feet 3 inches from the floor. The eastern bay is of one storey, 28 feet 9 inches in width and 10 feet 9 inches under the crane, while the western bay is approximately the same width, but is of two storeys containing a gallery 10 feet high, the floor of which is 20 feet 7 1-2 inches above the main floor. The roof trussed structure is also shown in this view while this and the side view given show the ample allowance that has been made for lighting

New Foundry, John Bertram & Sons, Limited, Dundas.—Main Bay, Showing Cupola Room to Right.

space. The brick used in the construction is from the Port Credit plant.

The door frames are of cast iron and the window sills cement reinforced. The glass in the skylight is reinforced by wire and the entire building has practically no combustible material except a layer of planking in the roof, which is well protected from the outside by fireproof material.

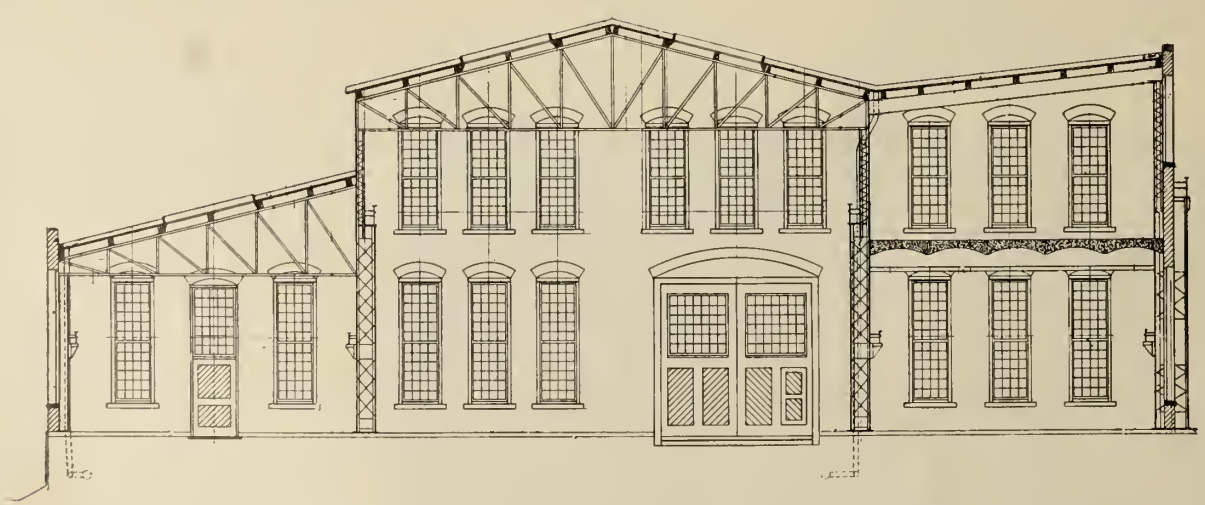


New Foundry, John Bertram & Sons, Limited—East Side Elevation.

Inside Arrangement.

The general scheme as devised and carried out has the end in view of the greatest economy in manufacture, and the latest practice known to the foundrymen both in materials and devices have been adopted. In the arrangement of the departments it has been so planned as to have the most harmonious connection between them to promote expeditious and at the same time high-class work. The floor is composed of 6 feet of sand, having been filled in specially, as is apparent, a very large amount of special sand being necessary to supply this. This gives ample depth for the largest floor castings that may be required. A minimum of hand labor is one of the points that have been kept in mind in this arrangement. The different departments include the east wing, which along its entire length is devoted to floor moldings, as well as the main centre bay for the same purpose, while the west aisle besides containing the gallery above, includes the core room with the large ovens, the cupolas as well as a molding floor, where will be situated the molding machines and where snap work will be done.

The cupola room is situated near the middle of the west wing and is brick walled from the rest of the building. In this has been placed two cupolas. The room is 22 x 29 feet, giving ample room for the operations required. The large cupola is 60 inches in diameter inside lining, and a smaller one 40 inches, both fitted with spark arresters, the blast being furnished by Root No. 6 blower. Here are also situated the tumbling barrels, in which the furnace bottoms are cleaned whence the scrap iron is returned to the charging floor to be remelted. A large elevator connects this room with the gallery floor. This may be loaded directly from the cars and the pig iron landed on the charging floor above with a minimum of effort. On the opposite side of this room is a sand and coke elevator, manufactured by the Waterous Engine Works Co., Brantford, which can also be fed from outside, by means of which the sand and coke are carried to the gallery floor. The blower mentioned above is directly connected to a Westinghouse 40 H.P. induction motor, the same blower serving both cupolas. The conveyor, elevator, tumbling barrels and sand-coke conveyor on the gallery floor are all operated by individual motors.



New Foundry, John Bertram & Sons, Limited—End View Showing Steel Structure.

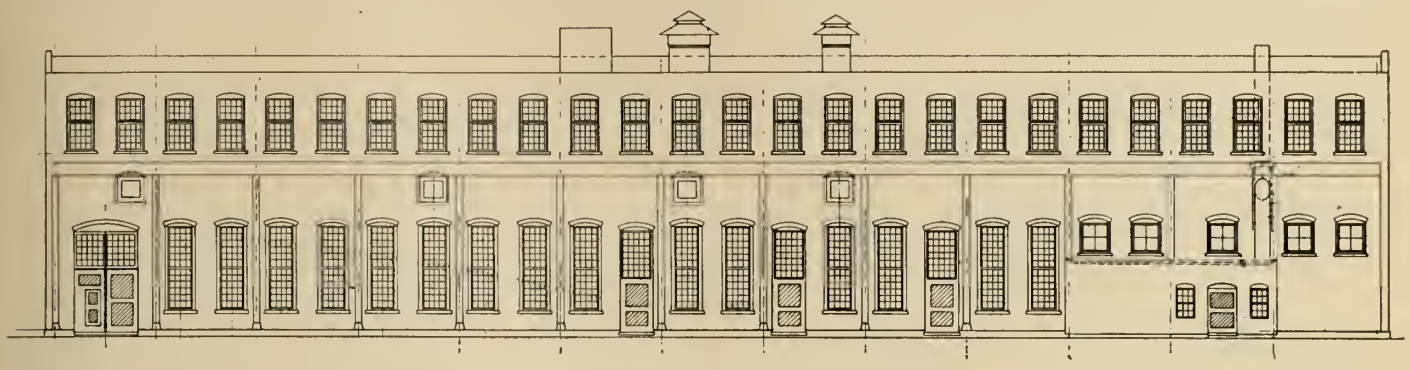
Core Room.

In this department a space of 70 feet by 28 feet 3 inches is reserved, the entire floor being covered by a 5-ton Niles traveling crane and in the rear of which are situated the core ovens. Two of these are 30 x 14 feet and another 12 x 20 feet, all brick lined in cement. All three ovens are fired from one central furnace by coke, but it is proposed to utilize natural gas, which has been available in Dundas for about a year at 30 cents a thousand.

Gallery Floor.

This feature of the building is probably one of the most important in connection with the plant inasmuch as it

embraces a large number of features that go towards economy of production and the lessening of labor. The floor of this gallery is of concrete, the detail of which is shown in the end view of the building, and the roof structure immediately over the cupolas and for some distance on each side is of the same material. This comprises the charging floor for the cupolas as well as the store room for sand and castings. Connecting with the sand and coke elevator from below an endless conveyor whose scope extends to the south end of the building. The coke is deposited from the elevator in a large wire bin situated near the charging doors of the cupolas, so that practically no distance is required to be covered on the part of the operator in charging. The sand conveyor conveys the sand to as many different stations as may be required, the dumping being accomplished by means of sliding doors situated on the floor of the conveyor. Here the sand is treated, whence it is shovelled through circular trap doors which lead to the different molding floors where the sand is required. A view shows the general lay-out of this floor and the situation of the apparatus just described. The mixing of the sand on this floor by means of power sand mixers and its conveyance by shutes to the different sections of the foundry is a great economy, as when the sand is mixed on the molding floor it is extremely difficult to convey.

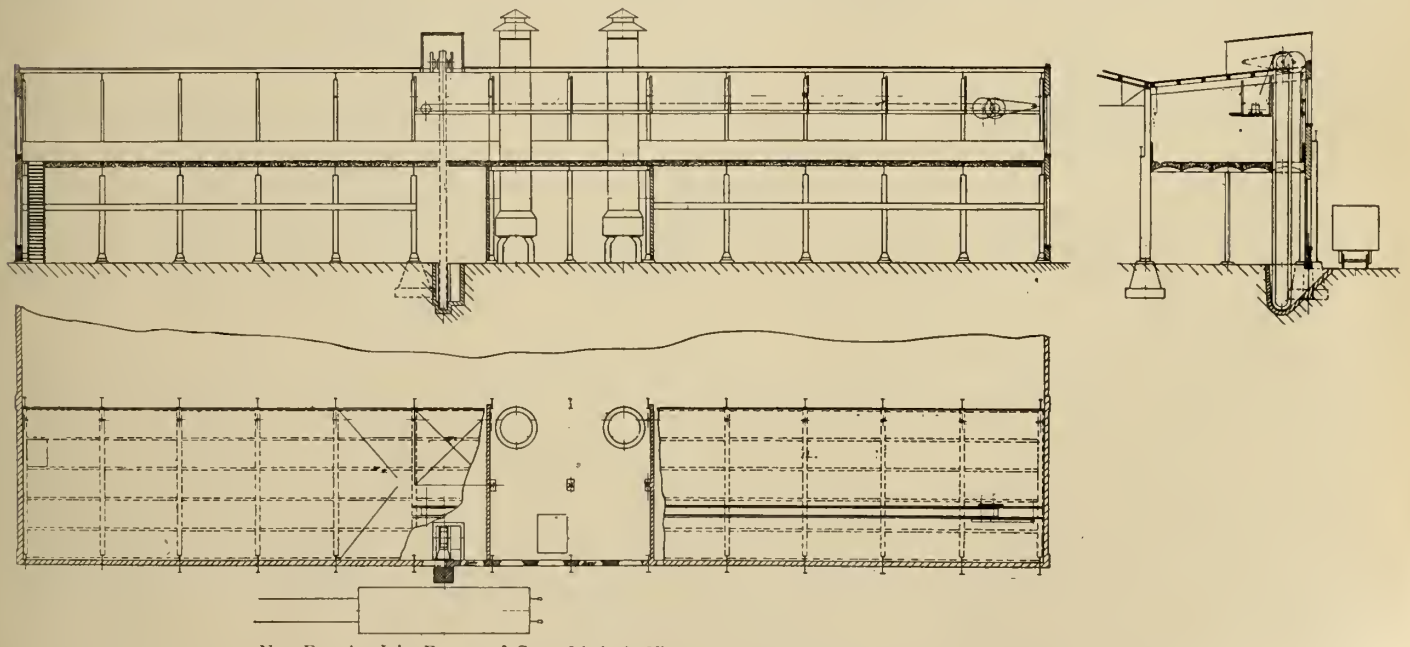


New Foundry, John Bertram & Sons, Limited—West Side Elevation.

Transportation Facilities.

A plan of the building and nearby grounds shows the general track arrangement by means of which cars may bring their raw material alongside the foundry and convey it directly to the elevators already mentioned, or makes possible bringing a car into the centre aisle of the building where material may be loaded directly by means of the large crane. In the building itself the different departments are served by traveling cranes, the east bay being covered by two of 5-ton capacity and the centre bay by a 25-ton crane fitted with a 5-ton auxiliary hoist. The steel girders for these were furnished by the Phoenix Bridge Works. In addition to this, for the middle bay, an auxiliary 10-ton crane is to be installed. In the west side a 5-ton crane conveys the material to and from the different parts of this department. Besides these labor-saving devices a yard crane is to be installed with a 60 foot span for the economic handling of outdoor materials.

In addition to the equipment already mentioned a complete air compressor plant is being installed. This is to be operated for chipping and cleaning patterns, running air hoists, blowing molds, pneumatic sand shakers and pneumatic molding machines, of which an up-to-date equipment is being installed. Each floor is furnished with water service and hose for wetting down the sand before tamping. The comfort of the men has been considered in the heating, ventilating, lighting and lavatory installations. The heating is accomplished by direct radiation, the system of coils being placed next the outside walls and on the column of the centre bay thus form-

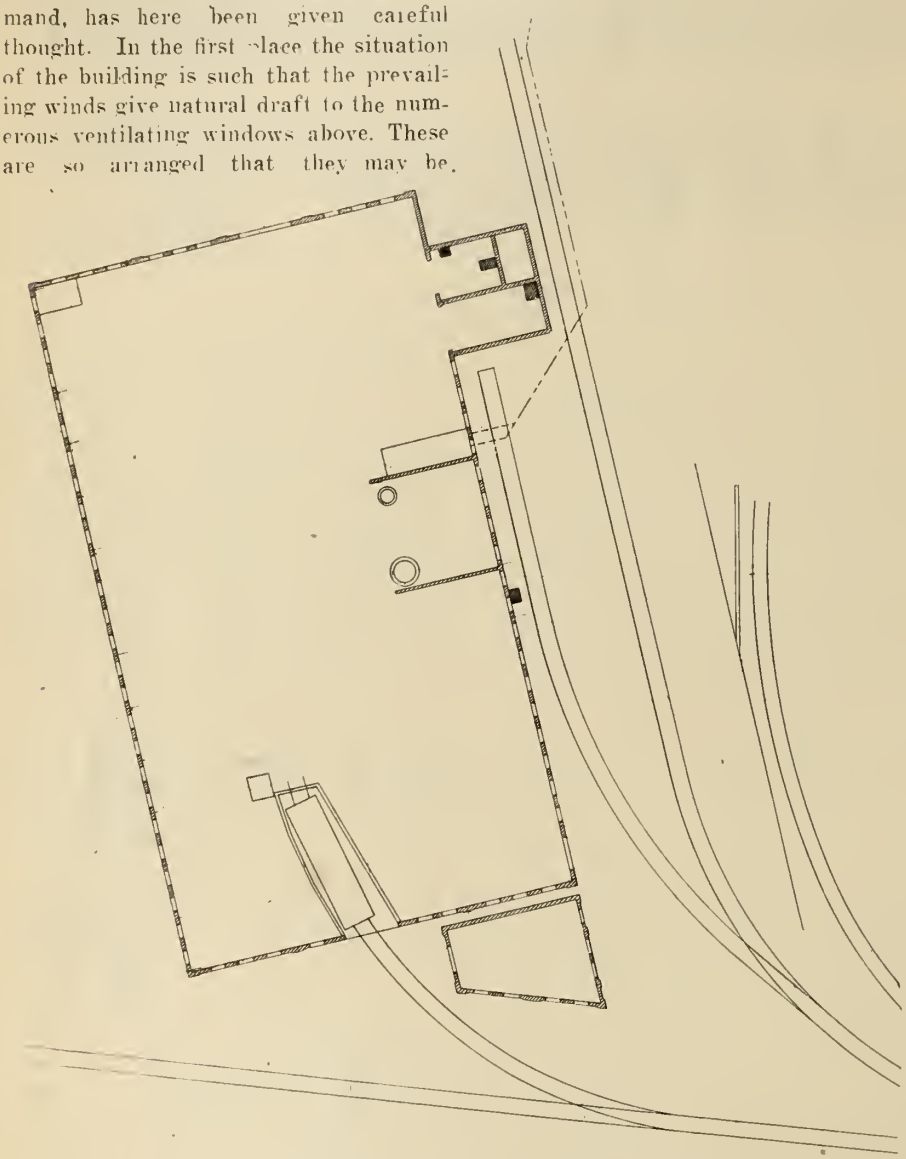


New Foundry, John Bertram & Sons, Limited—Views of Cupola Room and Gallery Floor Showing Elevators.

ing partitions between the departments and providing places which may be used as storage room for materials in every day use. A temporary boiler at present supplies the heat required, but later this building as well as the works will be heated from a central heating station.

The ventilation, which is such an important feature in the foundry building and which so often receives less consideration than the circumstances demand, has here been given careful thought. In the first place the situation of the building is such that the prevailing winds give natural draft to the numerous ventilating windows above. These are so arranged that they may be operated independently. The apparatus in connection with the operations of these is furnished by the King Construction Co., Georgetown. On the west bay the window sashes are made to swing on pivots, and these likewise may be opened independently or in groups.

The lighting of the foundry is another serious problem, but which seems to have been settled in a most admirable manner in this case. The exterior views will give some idea of the excellent lighting facilities afforded by natural means, but this is supplemented on a large scale by artificial light. It was finally decided to use Nernst lamps for this purpose, this being the first installation, on a large scale, of these in a factory equipment in Canada, but their utility has already been demonstrated in large industrial concerns in the United States. About 42 in all will be required and during the days when artificial light is needed in the morning and in the evening, will supply the workmen with all the light necessary.



New Foundry, John Bertram & Sons, Limited—Plan Showing Railway Switches.

Transformer House.

The whole plant is to be electrically driven from a central transformer station, shown in the plan at the north end of the foundry. The building itself is essentially fireproof, being constructed of concrete and brick, with fireproof roof. It is being installed with a capacity of 400 K.W., the power being supplied by the Cataract Power Co., Hamilton. In addition to the kilowatt capacity mentioned, an additional set of transformers will prevent any accident stopping the works for want of power. A 175 K.W. motor generator set, manufactured by the Canadian General Electric Co., will supply the direct current for the cranes. A 75 H.P. motor will run a Canadian Rand drill air compressor, and a 1,000 gallon, electrically driven fire pump will supply pressure for the water mains. A large panel switchboard takes care of the incoming lines and the distribution of the electrical energy to the different parts of the plant.

PERSONAL MENTION.

Mr. E. R. Clark, hydraulic engineer, has severed his connection with the Canada Foundry Co., to go into business for himself, having become associated with Connor, Clarke & Monds, consulting engineers, 36 Toronto street, Toronto.

Mr. R. A. Wallace, for the past four years superintendent for the Hamilton Gas Co. works, has resigned his position and will leave shortly to accept a very important position at Quebec, that of superintendent and engineer of the Quebec Gas Co. Mr. Wallace has been connected with the Hamilton Gas Works since he was a boy, and has worked up step by step until he reached the highest position in the company's services.

The delegates who have been appointed to represent the Toronto Board of Trade at the 6th congress of Chambers of Commerce of the Empire, to be held at London, Eng., on July 8, are Messrs. A. E. Kemp, M.P., W. F. Cockshutt, M.P., J. W. Woods, J. F. Ellis, J. D. Allan, D. R. Wilkie, W. J. Gage, R. J. Christie, Noel Marshall, C. W. Band, J. D. Ivey, C. W. I. Woodland, Lieut.-Colonel G. T. Denison and F. G. Morley.

Election of T. P. A. Officers.

At the second annual meeting and banquet of the Technical Publicity Association, held Thursday, April 5, at the Aldine Association, New York, the following officers were elected: President, F. H. Gale, General Electric Co.; 1st vice-president, H. M. Cleaver, Niles-Bement-Pond Co.; 2nd vice-president, C. B. Morse, Ingersoll-Rand Co.; secretary, Rodman Gilder, Crocker-Wheeler Co.; treasurer, H. M. Davis, Sprague Electric Co.; members of executive committee, Robt. L. Winkley, Pope Mfg. Co., and G. M. Basford, American Locomotive Works; members election committee, C. W. Beaver, Yale & Towne Mfg. Co.; Chas. N. Manfred, Johns-Manville Co., and H. H. Kress, A. S. Cameron Steam Pump Works.

Construction and Improvement

General Construction *Contractors' Supplies*

HEATING AND VENTILATION OF FACTORIES.

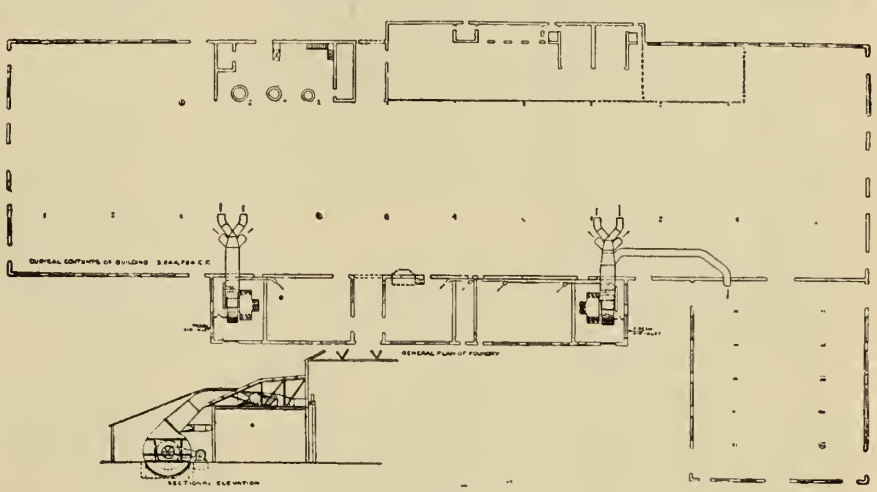
METHODS adopted for supplying and distributing the air in buildings are worthy of considerable attention. The usual methods of supplying heated air are : first, to take the air entirely from without doors and force it directly into the building through distributing ducts. This method is generally known as the plenum system. The pressure produced in the building causes a continuous exit of air from the building, either through the natural openings, as is usually the case in factory and other large buildings, or through special vent openings provided for the purpose, as in public buildings. This effectually prevents the entrance of cold air from without.

A second, and more common method for shop buildings where forced ventilation is not a necessity, is to draw the supply of air entirely from within the building and again force it through the distributing ducts, causing a continuous circulation of the air within the building. This often has an advantage over the plenum system in that all the heat supplied to the air is effective in heating the building.

Some Adaptations.

The ideal system is a combination of the plenum and return systems. This should be used wherever possible. In this system the greater portion of the air is returned to the apparatus, but sufficient air is continuously taken from without through a fresh air connection to create a plenum within the building and prevent the inward leakage of the cold air along the floor.

Excellent results can be secured by the use of overhead piping, providing it is not placed at too great distance from the floor. The chief advantage of the overhead system is the saving in first cost, since, on account of the high temperature and velocity of air in the distributing pipes, a great amount of heat can be transferred with a very small amount of material. The cost of the galvanized iron distributing system of air ducts is relatively small. The best results are secured with outlets at from 12 to 18 feet above the floor line. Above this height it is preferable to use drop pipes extending downward along the columns where they will not interfere with traveling cranes. Such an arrangement of overhead piping is frequently employed in foundries, while in large machine shops underground ducts are nearly always preferable. Another system which has proved very satisfactory is that in which a distributing air return duct is employed. This approaches very closely in principle to the plenum system used in public buildings, and is a combination of both plenum and exhaust systems. The peculiar feature in this is that no distributing ducts or piping for the heated air are used. The air is blown at a comparatively high velocity directly into the building at about 8 or 10 feet above the floor through an outlet branching in three directions, and through which the air passes at a comparatively high velocity. The distribution is effected entirely by the return vent ducts which are placed at frequent intervals along the walls. These open into large return air channels which are provided on either side of the building and serve the additional purpose of affording a convenient place for locating steam and water mains, and also electric light and power mains. Provision is made for taking a portion of the air from without doors to secure a plenum. One great advantage of this plan is that it removes all cold air leaking into the building at the floor line, and that produced by the cold down draft next to the walls, as well. A perfect distribution is secured in all parts of the building, and the cost of installation is reduced to a minimum. In small buildings a system of distributing outlets is placed along the further side of the building, and a system of vent ducts opening into exhaust chamber is placed on the side adjacent to the fan. In many instances an elaborate distribution is impracticable or undesirable. In such cases a centrally located discharge pipe may be used. From this point the air is blown in all directions and a circulation is produced by an exhaust connection to the fan inlet. In such instances very effective heating has been secured even where it was required to blow the air long distances. A good example of such a system may be found in the foundry building of the General Electric Company at Schenectady. This foundry, which is probably one of the largest in the world, is heated in an entirely satisfactory manner with a few large branch outlets.



Type of Foundry Heating Apparatus with Small Amount of Distributing Pipe.

The chief points of excellence of the fan system may be summarized as follows : 1—Perfect ventilation, regardless of exterior conditions. 2—Uniform and proper distribution of heat. 3—High efficiency of heating surface, (three to five times that of direct radiation). 4—Greatest economy in operation. 5—Utilization of exhaust steam. 6—Prevention of cold drafts from without by production of a plenum. 7—Independent regulation of heating and ventilating effects. 8—Central location of plant, requiring a minimum amount of attention. 9—Great flexibility in operation to suit varying conditions. 10—Low cost of installation.

A man may have enough of the world to sink him, but he can never have enough to satisfy him.—T. Brooks.

CANADIAN MACHINERY
and Manufacturing News

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, technical progress, construction and improvement, and to all users of power developed from steam, gas, electricity, compressed air and water in Canada.

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Vol. II. MAY, 1906 No. 5

NEW ADVERTISERS IN THIS ISSUE:

A. Dillon & Son, Portobello, Scotland.
"Electrical Times," London, Eng.
"Engineering," London, Eng.
D. Maxwell & Sons, St. Mary's, Ont.
R McDougall & Co. Limited, Galt, Ont.
Tees & Persse, Limited, Winnipeg.

WE WANT CHEAP POWER.

SUCH was the slogan of the monster delegation that waited on Premier Whitney of Ontario and his cabinet on Wednesday, April 11, where representatives of the various municipalities urged upon the Government the immediate necessity of prompt action to secure and place at their disposal power generated from the Canadian Niagara Falls. This delegation was without doubt the most important and influential that has ever waited upon the Ontario Government. The question is a vital one, in fact no more important problem has heretofore confronted manufacturers of Ontario than the question now under discussion. The two reports, that of the Municipal Power Commission and the Ontario Hydro-Electric Power Commission, have been published and the figures contained in them have caused no small excitement in Ontario municipalities.

As these reports are based upon figures supplied by engineers of repute and have been made after months of investigation on the part of those delegated to take up the work, they must be given attention and held worthy of consideration on the part of all interested. The figures quoted in these show conclusively and undeniably the advantage that would accrue to manufacturing interests, and through them to the whole country, if power were available at the different centres at the prices quoted. One thing that has been brought out in a definite manner and which has caused many people to open their eyes in amazement is the fact of what a valuable asset our water-powers are and what a boon to the country it would be if power from these were supplied at a trifle over the cost of generating.

The Government has as yet in no way committed itself on the question as to whether it will assume control over the power developed or in what way it will endeavor to have it delivered throughout the country. The problem before it is a momentous one, but one that in the face of what has already been done and in view of public opinion in the matter must be dealt with immediately. Those who have invested their money in and shown enterprise in developing the power on the Canadian side deserve consideration, but what the Government must do is to see that Ontario gets the benefit of Niagara's power and that manufacturers are supplied with it at reasonable rates.

CANADIAN CATALOGUES WANTED

CANADIAN manufacturers seeking to extend their trade in Australia, or establish a connection with this sister colony, will be interested in the report of Mr. D. H. Ross, Canadian Commercial Agent for Australia. Some months ago the Department of Trade and Commerce invited manufacturers to supply the various Canadian Commercial Agents with catalogues, export price lists and discount sheets, and the invitation, it appears, did not meet with a general response. The sole object in view was to benefit manufacturers in this country by giving the commercial agents a thorough understanding of the lines produced.

Mr. Ross says there is no doubt the object in view is to give the agent such a firm grasp of the manufacturing advance made by Canada as that he shall, without delay or difficulty, be in a position to advise any local merchants as to Canadian sources of supply and conditions of delivery. Canadian manufacturers or exporters must forthwith disabuse their minds of any suspicion of the idea that the commercial agents would show undue preference to one manufacturer over another. For the commercial agent's influence, as a whole, is employed on behalf of all Canadian exporters, and can take no cognizance of individual or associated speculation. It is well worth some sacrifice of a commercial agent's time and convenience to satisfy on the spot intending importers anxiously seeking information regarding Canadian goods, when the question of over 10,000 miles between Canadian manufacturing centres and Australia precludes intending buyers sending for price lists and obtaining quotations in time for a season's or urgent requirements. The question of having quotations in sterling (£ s. d) is not essential, as importers are accustomed to purchasing goods from United States price lists. Canadian firms already represented in Australia should inform the commercial agents of the names and addresses of their representatives, so when occasion arises the latter may be referred to.

ITALY AS A MARKET FOR CANADIAN PRODUCTS.

FEW people in Canada realize what a change has come over Italy in the last few years. Most of us know that country from our ancient histories and from the hard working, but ignorant and excitable navvies who build our railways and work on our big contracts.

Some time ago Marquis Doria was sent to Canada to see whether trade between this country and Italy could

not be developed. During the last few weeks the marquis has seen many Canadians—leading representatives of the political and commercial life of the country—and has opened our eyes to the possibilities for a really valuable exchange of products and has suggested the advisability of the encouragement of a direct steamship line between Mediterranean ports and Canada. It would open a most valuable part of Europe for Canadian trade. Such a line would be of much more importance to Canada than even our Australian, Mexican or South African routes, because we could place our farm products and many of our manufactures in a short time right among an immense consuming population. Such a line would open a market for Canadian shippers and importers, a district not now touched by Canada at all, Southern France, Switzerland, Northern Italy and Austria, and all these countries are just beginning to take an interest in Canada.

If Canada is to take advantage of trade opportunities with Italy and other countries on the Mediterranean, it is imperatively necessary that a line of steamers should run regularly between this country and ports on that sea.

Italy is a country which, while producing a great many things that this country requires, is also a large importing country. She imports about $12,000,000 worth of machinery, to say nothing of about 5,000 tons of agricultural implements, from plows to reapers. The imports of lumber aggregate about $13,000,000 ; of coal, 5,000,000 tons ; of wood pulp, 30,000 tons. Another Canadian industry which would be benefited by a direct line would be the wheat industry. Italy imports on an average of about 30,000,000 bushels per annum. Last year she imported over 40,000,000 bushels.

MORE CHEMISTRY FOR THE FOUNDRY.

IN his talk on "Foundry Chemistry" at the annual meeting of the Society of Chemical Industry, Mr. H. L. Bowers emphasized the necessity of more scientific methods being adopted in the foundry. The present practice of grading iron by fracture is unreliable and not in accordance with modern methods. A chemical analysis is necessary and until this is adopted, not only by larger firms where such is already the case, but by smaller foundries, there is sure to be dissatisfaction. Even the sand should be analyzed, as its proper constituents mean the difference between good and bad castings. When the chemist is given a berth in the foundry or when the aspirant for the position of foundry foreman is able to undertake chemical analyses, more can be hoped for from that department and fewer instances will be recorded of the foundry running at a loss, as has been too commonly the case in the past.

READERS MISS OFFERED OPPORTUNITY.

AN incident arose the other day which serves to illustrate a point we have desired to make for some time. Among others a subscriber in Guelph wrote to Allis-Chalmers-Bullock, Limited, asking them to forward copies of the dainty little desk calendar which they are getting out from month to month. In referring to the incident the firm mentioned expressed the view that not only were they ready to do the little favor asked but they appreciated the inquiries and would like every firm who had not received a copy to send for it.

We would like every reader of Canadian Machinery to understand this attitude, which is probably true of every advertiser in the paper. The advertiser desires to get into touch with every buyer of his lines. The subscriber wants to learn as much as he can about the most up-to-date machinery, power equipment, etc. The most logical way for these two classes to get together is for the subscriber to read the advertisements, the catalogue reviews, the references in the reading columns to new apparatus, and when anything interests him, to write for it. Write for all literature you see referred to in Canadian Machinery. The advertiser will appreciate such inquiries and you will get information of real value to you.

TELEPHONES FOR ALL.

A TELEPHONE monopoly has had much to do with making the telephone of less universal service than it should be and in view of its utility much less than what might well be expected of it. A bill presented by Hon. Adam Beck before the Ontario Legislature is worthy of commendation, providing, as it does, that municipal councils may organize a telephone system if a group of twenty citizens wish it, and that the municipality petitioning for such a system and showing a plan of the proposed line may set to work on its installation, the cost of the line being defrayed by subscribers. Furthermore, it provides that with the consent of the postmaster-general the switchboard may be located in the local post office. This should give a boom to the telephone in rural districts and should hasten the day when every farmer in the land is connected to his neighbors and the outside world by telephonic communication.

USELESS ENERGY FOR TECHNICAL STUDENTS.

LACK of co-operation between its different departments has often led to the downfall of a promising concern and this very cause is every day working towards an impairment of profits in industrial establishments. In the rush to turn out a maximum output, systematic methods may be overlooked with disastrous results.

There may be some cause for this in the turmoil and activity of an overworked factory, but in a seat of learning where we expect to find the embodiment of quiet, thoughtful, systematic harmony, there is no excuse whatever. A flagrant breach of this principle has just come to light in the science department—of all places the most unexpected—of one of our universities, in which the students have been the sufferers and where gross mismanagement on the part of those in charge has been displayed. In the science course the lectures are supplemented by practical work in the laboratories, where the budding engineer is shown the how of the why and the wherefore given in the subject matter of the lectures he attends. This is particularly true of the subjects dealing with the actual practice of the engineering profession. The professor elucidates the theory and the demonstrator follows up with its application to actual practice. Imagine, if you can, anything more incongruous than these two carrying on their work on independent lines and in ignorance of the other's line of treatment. Yet this is absolutely going on.

As a concrete example, a demonstrator in electrical engineering has been taking up work weeks before it was touched upon by the lecturer, passing over work then being discussed in the class room. For instance, during the term just past he had his students working on the design of a 100 k.w. transformer before they were well launched, in the lecture room, upon the elements of magnetism. In the interests of technical education and for the conservation of energy this should not be the case, but a little more common sense applied where it is supposed to be found in abundance, but where, alas, it is sometimes sorely lacking.

Electric Power for Ontario

MATTERS of the most vital importance to the manufacturers of Ontario have been taking place within the past few weeks. The report of the commission appointed by several municipalities of Ontario to inquire into the cost of developing the power at Niagara, has been handed in, the report of the Hydro-Electric Power Commission appointed by the Ontario Government has been submitted, and the most influential delegation representing all the important municipalities of Western Ontario has waited upon the Ontario Government, urging immediate and definite action on the part of the legislators towards securing power at reasonable rates for the manufacturing industries of the western peninsula.

RETURNED
APR 26 1906

The Hon. Adam Beck,
Whose work has aroused the interest of every Ontario manufacturer.

The Municipal Power Commission, under the chairmanship of Mr. E. W. B. Snider, of Waterloo, which was appointed by the cities of Toronto, London, Brantford, Stratford, Woodstock, Ingersoll and Guelph, recommended the establishment of a municipal power station at Niagara Falls. Included with this was a most exhaustive report made by Messrs. Ross and Holgate, hydraulic and electrical engineers, of Montreal, coupled with a report of Prof. R. A. Fessenden, of New York, and upon these the commissioners' conclusions are largely based. In the event of other municipalities being unwilling to take up the matter it was recommended that the municipalities named carry out with all possible expedition a development of 60,000 h.p. The rates showing the enormous difference between the price it would be possible to supply power to manufacturers if this recommendation were entered into, and the cost that manufacturers are at present obliged to meet in the production of power, were shown.

Cost of Power and Light.

The variations of price required to meet the varying duration of service demanded by consumers must be settled by the operating commissioners with regard to the local conditions of demands, etc. These will vary in each municipality, and, as they will remain unknown until the supply contracts are entered into, they cannot be intelligently approximated.

I. Motor service per h.p. per annum, 24-hour service at consumers' premises :

	30,000 h.p.	60,000 h.p.	100,000 h.p.
Toronto	$21.97	$15.73	$14.60
London	.115	.0925	.0389
Brantford	30.02	17.93	15.57
Guelph	27.68	18.26	16.70
Stratford	33.67	21.45	19.42
Woodstock	34.48	21.05	17.53
Ingersoll	33.96	21.61	17.99

II. Are lighting, cost per lamp per year :

	30,000 h.p.	60,000 h.p.	100,000 h.p.
Toronto	$42.02	$37.61	$36.48
London	54.08	44.89	41.36
Brantford	49.73	42.91	40.55
Guelph	47.84	40.69	39.13
Stratford	56.83	47.23	45.20
Woodstock	56.16	48.16	44 64
Ingersoll	72.58	64.02	60.40

III. Incandescent lighting, cost per k.w.h.:

	30,000 h.p.	60,000 h.p.	100,000 h.p.
Toronto	$.0741	$.0640	$.0614
London	115	.0925	.0839
Brantford	.0945	.0778	.0720
Guelph	.114	.0965	.0926
Stratford	.1218	.0983	.0934
Woodstock	.1307	.1091	.0995
Ingersoll	.1321	.1112	.1023

IV. The surplus power generated and transmitted with the object of serving the subsidiary municipalities would cost at the municipal sub-station switchboards—that is, without any allowance for the local distributing cost—as follows :

Cost per h.p. per annum at municipal switchboard :

Hamilton	$ 8.89
St. Thomas	15.09
Paris	12.19
Dundas	11.13
Mitchell	24.62
St. Mary's	19.67
Berlin	12.68
Waterloo	14.55
Preston	16.00
Hespeler	20.06
Galt	15.85

Present Cost of Steam Power.

The average costs of steam engine power developed for ten-hour day industrial use under the general conditions prevailing in the municipalities

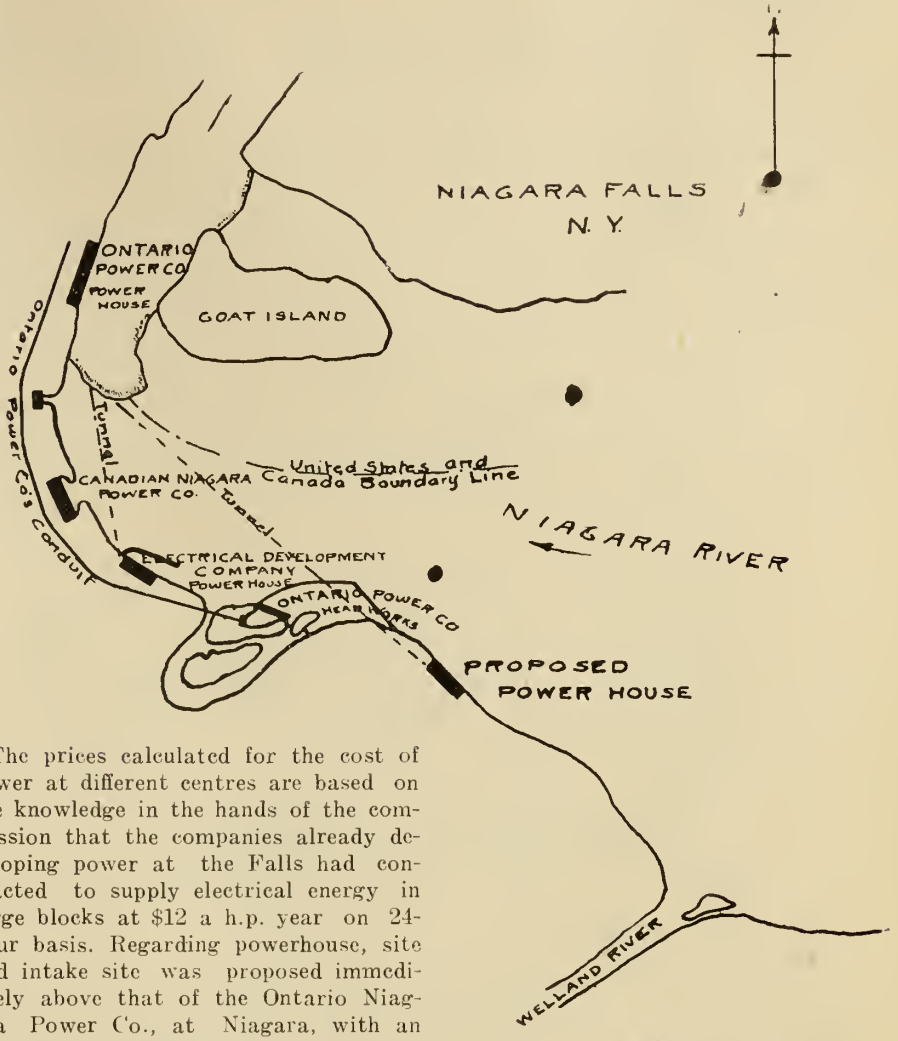
your commissioners represent have been investigated and computed as undernoted. The costs for a twenty-four hour service required in public service plants vary with the peculiar conditions of each undertaking, but they are, of course, much higher than those given below. The arc and incandescent lighting rates are reported by the engineers as varying considerably, but the undernoted scale is submitted by them as a fair approximation for ten-hour service:

	h.p.	
Indicated h.p. of plant.....	10	$111.50
Indicated h.p. of plant.....	25	78.00
Indicated h.p. of plant.....	50	57.50
Indicated h.p. of plant.....	75	53.50
Indicated h.p. of plant.....	100	48.00
Indicated h.p. of plant.....	150	40.60
Indicated h.p. of plant.....	250	32.00
Indicated h.p. of plant.....	500	27.80
Indicated h.p. of plant.....	750	24.00

These prices are based on a 75 per cent. load, which corresponds with average existing conditions.

The Government Commission.

The report of the Hydro-Electric Power Commission was signed by Hon. Adam Beck, chairman, Messrs. George Pattinson, M.P.P., and John Milne, the other commissioners, with an appendix containing the report of the engineer of the commission, Mr. Cecil B. Smith, on the operation, transmission and distribution of electric power. The report consists of a series of tables and maps setting forth with almost incredible detail and completeness, including all necessary calculations, a plan for distribution throughout the southern and western parts of the province of electric power from Niagara sources. It was recommended to purchase the right of way from Niagara to five separate divisions, with centres at Hamilton, Toronto, Guelph, London, and Windsor, as the market for 50,000 h.p. is available at once, and within five years 100,000 h.p.

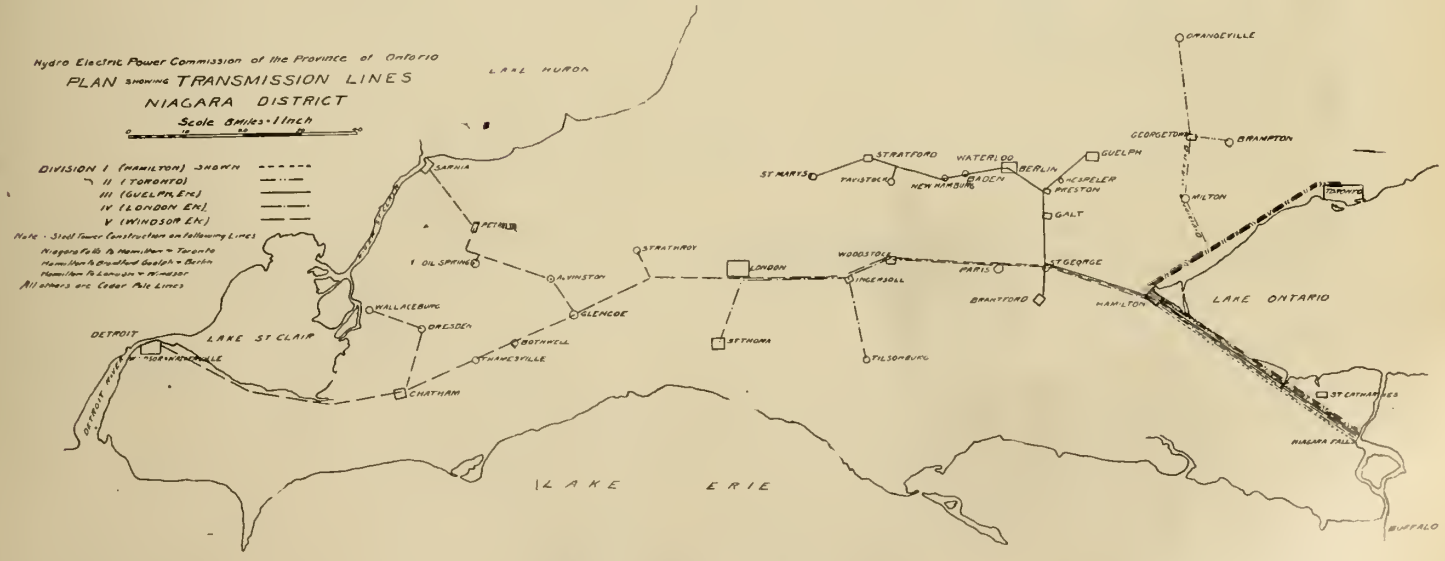


Site of Proposed Municipal Power House.

The prices calculated for the cost of power at different centres are based on the knowledge in the hands of the commission that the companies already developing power at the Falls had contracted to supply electrical energy in large blocks at $12 a h.p. year on 24-hour basis. Regarding powerhouse, site and intake site was proposed immediately above that of the Ontario Niagara Power Co., at Niagara, with an alternative site 18 miles west of the Falls, where double the head could be obtained, and therefore but one-half the water necessary to be diverted.

The transmission of power estimates are based upon the purchase of a private right of way over the entire district; 100 feet wide between Niagara and Hamilton, 66 feet wide between Hamilton and Toronto, and 33 feet wide alongside of highways or railways for the remainder. The class of construc- those from Niagara through Hamilton

(Continued on page 202.)



Proposed Transmission Line in Western Ontario.

Mechanical Reviews

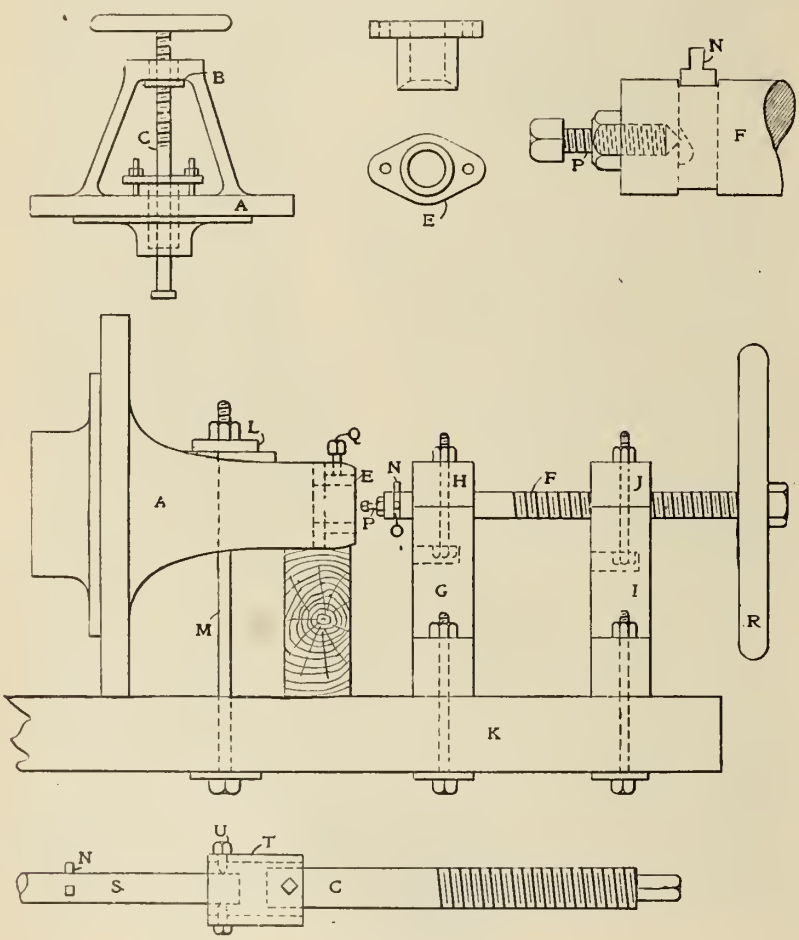
OPINIONS AND STUDIES WORTH NOTING

RE-CUTTING STRIPPED NUT AT SEA.

WHILE packing the main stop valve of the boiler of a British tramp steamer, I discovered accidentally that the nut (B) was nearly worn out. In the illustrations (A) shows the cap of the main stop valve with the yoke cast in one piece. The nut (B) for the screw (C) is let in from underneath and has a flange to take the thrust. It is held in place by the set-screw (Q), shown in the lower illustration. I took the cap off the valve and knocked the nut (B) out. In the storeroom I found an old winch gland, (E), of brass, which was a little smaller than (B). I wrapped a strip of tin around the body and drove it into the yoke. On measuring the screw (C) I found it to be about $1\frac{3}{4}$ inch outside diameter, four square threads to the inch. The screw (C) was in new condition, having been in use only about three months. A further search in the storeroom revealed an old valve spindle, (F), $1\frac{1}{4}$-inch diameter, the same pitch as (C), with the thread in good condition. I decided to use this, as it would save me considerable trouble in the cutting of the new nut over what I would have if I used the spindle (C).

I got a piece of plank, (K), 3 inches thick by 12 inches wide and about 4 feet long. This was trued up on one side and one edge so as to facilitate setting the different members of my threading machine. The cap (A) was bolted in place as shown, care being taken to have it square and parallel with the plank (K). An "old man" was then bolted to the plank and the nut (E) bored a little larger than the bottom diameter of the thread (C). The wooden bearing (G) was then put in place and its cap (H) fitted. A bar with a scriber on its end was passed clear through the cap (A) and nut (E). With this a circle was scribed on the face of (C). After transferring the circle to the other side, the bearing was worked out with a gouge. The bearing (I) was then bolted in place, scribed and worked out in the same way, but the hole in (I) was only the size of the spindle (F), at the bottom of the thread, while that in (G) was the size of the plain part of the spindle. The thread on the spindle (F) was then roughed with a chisel so as to cut a thread in the bearing (I) and cap (J). Both the caps (H) and (J) were put on loosely and gradually tightened down, while the screw (F) was rotated by the hand wheel (R). After the thread was cut in (I) and (J), the spindle (F) was taken out, the burs filed smooth and the square-threading tool fitted in the end. The end of (F) is shown enlarged at the upper right-hand corner. The square tool (N) was held in the hole by a set-screw (O) on the side. The pointed screw (P) and the inclined face on the tool (N) regulated the depth of cut. For the first four or five cuts the tool was driven back each time at the extreme end of the cut, so as to clear the thread on the backward stroke, but after the thread was about 1-32 inch deep this was found unnecessary. The thread was a good one, but it seems to me at this late date that I have taken considerably longer to describe the job than I originally took to do it.

I suppose while I am about it I better tell you how I would have cut that square thread if I had been unable to find that other spindle (F) which suited my purpose so admirably. I would have taken the spindle (C) of the valve and a piece of round steel or iron of suitable size, (S), say $1\frac{1}{4}$ inches or less in diameter by 18 inches long. I would have fitted up two plain bearings like (G) and spaced them a suitable distance apart. I might have put one on one side of the nut (E) and one on the other, as close as convenient for handling the threading tool. The next job would have been to make the threaded wooden journal, like (I), to fit the spindle (C). Then I would have taken a piece of pipe or old boiler tube and made a universal joint (T) by drilling holes clear through at right angles to each other. After threading these and fitting four pointed set-screws (U), I would have spotted the spindle end to suit two of the screws and the round rod to suit the other two. After fitting an adjusting tool, like (N), in the



HOW THE NUT WAS CUT.

round rod and coupling the rod and spindle together with the universal joint, the rig would be ready to put in the wooden bearings to cut the thread. —Dixie, in American Machinist.

REPAIRING A BENT PISTON ROD.

A COUPLE of months ago an engineer friend showed me that he had a badly bent piston-rod in a duplex triple-tandem compound pumping engine connected to a Holly system and operating condensing. The piston-rod that was bent was the outboard end of the intermediate, which is keyed to the crosshead, as is shown in Fig. 1. When I entered the engine-room the engineer had just taken off the outboard intermediate crank head; the crosshead key had not been drifted. I found it "clear home" with a 1-16-inch liner on the drawing side of it. We easily took out this key, and putting the piston-rod drift key in the slot at (J), a light tap with the soft hammer loosened the crosshead from the rod. I noted the looseness of the piston in the crosshead; also the key. I ordered a new key $\frac{1}{8}$ inch wider on its draft. We then took out the piston-rod and had it sent to the nearest machine shop. It proved to be out almost 3-16 of an inch and very near the taper fit to the crosshead. We turned it and chalked it where it was out, heated it several times and tried to straighten it, but we could not get the kink out entirely, so we concluded to turn off enough to

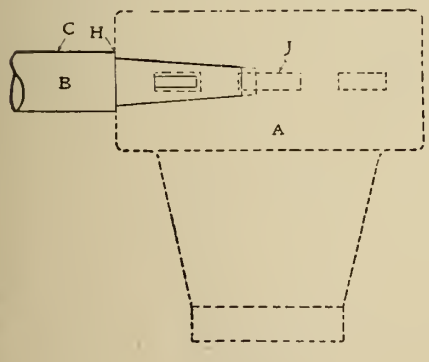


FIG. 1.

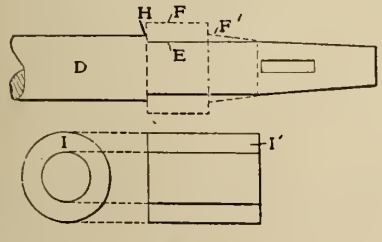


FIG. 2.

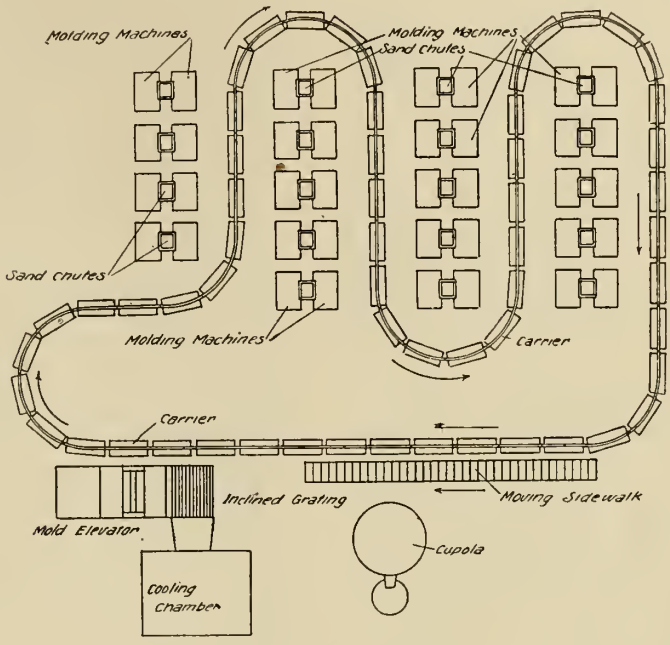
true it up, and in order to do this it was necessary to turn down the shoulder that is shown at (H), Fig. 1. This would tend to weaken the rod and the crosshead, so, after turning down the rod to the size shown at (D), Fig. 2, I found it necessary to turn down a portion of the taper from the keyway (G) to the shoulder at (H), thus leaving nearly as much shoulder as the rod had originally. A sleeve was made of round steel, large enough in diameter to exceed the original size of the piston-rod about $\frac{1}{8}$ inch, and long enough to fit over the entire portion of the rod that was turned down. This sleeve, or bushing, was bored, to drive onto the rod, tight enough to hold it for turning. The distance from the keyway to the original shoulder in Fig. 1 was measured and laid off with a pair of dividers. To make the taper on the bushing correspond with that of the rod, we turned the bushing until it appeared as shown by the dotted lines at (F) and (F1). After chalking this taper and trying the rod into the crosshead, we found it a very good fit, without the single application of a file to its surfaee. Then we had to take the bushing off the rod to put on the junk ring and to get the rod through the stuffing-box and the bushed gland, so we had the rod taken to the hydraulic press, and the bushing pressed off. We put the rod in the lathe again and eased off the fit as (E) with a file, enough to let the bushing ring on with a very light tap of the hammer. I put this arrangement together and drove the new key home, and it has been in continuous service since, giving entire satisfaetion, with a piston speed of 200 feet per minute against a head of 212 feet.—Power.

Do not forget that it isn't necessary to be disagreeable in order to disagree with the other man.

IMPROVEMENT IN FOUNDRY WORK

FOR centuries swarthy men have laboriously carried ladles filled with liquid metal to the most distant parts of a foundry. The new method is a complete reversal, for now the molds come to the cupola in an endless procession from morning to night. The result is, for small castings, a largely increased output at a great saving in cost.

The usual system in a foundry is an intermittent process. The greater part of the day is spent in making molds which are poured later on. This system works very well for large castings, but small castings can be made much quicker in a foundry equipped with the carrier system. In this method the melted iron is not carried to the molds, but instead the molds are brought to the cupola by the carrier shown in the diagram Fig. 1. This method not only saves time but also prevents the molten iron from cooling before it is poured.



Floor Plan of the Foundry

The operation of the new process is as follows: One of the molding machine operators opens the sand chute at the back of his machine and allows enough sand to fall into his machine to make one mold. He then turns on the compressed air which rams the sand better and quicker than can be done by hand. Then he turns another air valve which starts a pneumatic rapper constructed exactly like a pneumatic hammer. This causes the mold to vibrate and enables him to draw the pattern from the mold without any sand sticking.

The mold is then placed on the carrier which consists of a number of swinging shelves suspended from a track

overhead. These shelves are all connected to a chain which moves constantly in the direction indicated by the arrows in the diagram. When a mold reaches the moving sidewalk one of the pourers steps on the sidewalk with his ladle of iron and pours the mold. The moving sidewalk and carrier have the same speed, making it just as easy to pour as a stationary mold.

After it travels a little farther, during which the casting has set, it is removed to the elevator, which carries it up and dumps it on an inclined grating. This grating has a shaking motion which causes the sand to drop down through the bars, and passing through a hopper it lands on a rubber belt conveyer. It is here moistened with a spray and then discharged into a rotary sieve after which it is automatically conveyed to the sand chutes to be used over again.

The castings are too large to go through the inclined grating, but roll off the edge into the cooling chamber. After cooling they are tumbled and then separated in the automatic separator.—Popular Mechanics.

GREATER ECONOMY FOR THE GAS ENGINE.

ENGINES of the internal combustion type, though of comparatively high efficiency, are not nearly so economical as might be expected, due largely to the fact that the explosion temperatures and pressures fall far short of what they should be.

If we burn, for instance, an explosive mixture of gasoline vapor and air slowly and measure the heat developed, we would find that something like 22,000 heat units are developed by the burning of one pound of the fuel ; that is, enough heat is developed to heat 22,000 lbs. of water 1 deg. Fah. for every pound of gasoline burnt. Air, however, takes much less heat to raise its temperature than water, so that the same quantity of gasoline would raise the temperature of about six times 22,000, or 132,000 lbs. of air 1 deg., if the air were confined in a closed vessel.

At atmospheric pressure, 1 lb. of air occupies nearly 14 cubic feet, so that it will be seen that the burning of 1 lb. of gasoline would heat 924 cubic feet of air as much as 2,000 degrees.

This heat leaves the explosive mixture as fast as it is formed, and appears almost instantly in the water jacket or the cooling flanges—an evidence that it is there and might, if the proper means were found, be utilized.

Heat in its other form is work, therefore the most desirable way of getting rid of this heat would be to utilize it, make it do work.

The simplest way would be that in which a given quantity of fuel were made to heat a large quantity of air, calculating that quantity in such a way that at the temperature and pressures that now occur, the extra quantity would absorb all the heat otherwise wasted. That is, to use weaker mixtures.

The practical objection to this is that mixtures weak enough to absorb the waste heat and give it back as power are too weak to burn except under very high compression—and under very high compression the gasoline mixture will explode prematurely.

If the compression could be made in two stages, so that in the second stage the mixture enters the cylinder cool, the requisite compression might be had to work with mixtures of almost any degree of weakness.

In concrete form a double-ended cylinder like a steam cylinder might be used, the back end being fitted with three valves, two being the inlet and exhaust valves just like an Otto or four-cycle engine, while the third is a mechanically-operated valve through which the surplus air supply enters.

The front end of the cylinder would be an automatic pump acting every stroke —compressing the air to about 40 lbs. pressure and cooling it by passing it through a radiator, so that it would reach the working cylinder cool.

This pump acting every stroke would make the engine handle nearly three times the quantity of air per stroke and burn only the same amount of gasoline as previously required. The net result of Clerk's experiments was that instead of the engine utilizing 27 per cent. of the heat it utilized from 34 to 38 per cent. and avoided all the trouble previously encountered in over-heating and burning the valves, etc. The cylinder pressures are also correspondingly increased, so that for a given power the engine weight is not increased.

Another method does away with the air pump. In this arrangement a part of the exhaust is used over again, a tank being so connected up to the engine that just at the end of the working stroke, and while the exhaust is still under 30-lb. or 40-lb. pressure, a portion of the exhaust is allowed to enter the tank through an automatic non-return valve.

From the tank the cooled exhaust gases are admitted to the cylinder after the regular explosive charge has been drawn through the inlet valve and the regulation carburetter.

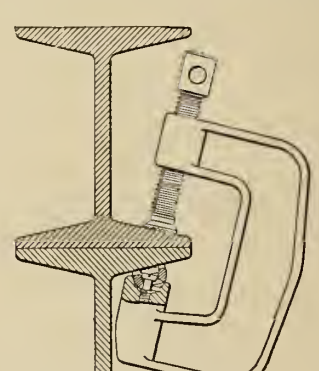
The objection to the use of the exhaust is that it takes a large radiating surface to cool it down properly, and also that the mixture weakened by it is not so combustible as with air.

A third method is to draw in the regulation charge through the carburetter and inlet valve and then, on the compression stroke, to inject the proper quantity of water ; that is, such a quantity of water as will be completely evaporated by the heat developed in compressing the charge. The objection to this is the extreme delicacy required in regulating the quantity of water used, as its presence in liquid form interferes with the ignition and makes the engine unreliable. However, in engines of upwards of 20-horse-power per cylinder it is quite feasible and greatly increases the power—though also the maximum pressures—so that when the attachment of water injection is applied, the crank and bearings, etc., have to be designed to stand from 50 to 100 per cent. greater pressure than ordinarily obtained in the four-cycle method of working. Merely as an illustration of the delicacy with which the water per stroke must be measured, it might be noted that the pump which would supply a 3x3 engine should not have a plunger displacement of over 3-16-inch diameter by $\frac{1}{4}$-inch stroke.

On a cylinder 6x6 this pump would still be very small, perhaps not exceeding $\frac{3}{8}$-inch bore and $\frac{1}{2}$-inch stroke, and even at that an ignition missed or a double stroke of the pump might put the spark, particularly the jump spark apparatus, out of commission. — Gas Power.

SCREW CLAMP WITH SPHERICAL ADJUSTMENT.

ROBERT GRIMSHAW sends a sketch of a clamp designed for holding objects, like the flanges of I-beams, that do not present parallel surfaces. It is made of a steel casting and has an "I" cross section with



An Adaptable Clamp.

stiffened back, and if sprung can be brought back to proper shape when hot, like forged ones. The spherical bearing on the under jaw allows all the adjustment out of parallel that is ever likely to be called for.—Machinery.

It is the little things, the trifles, which cut down the average of success possibility.

Foundry Practice

MODERN IDEAS FOR THE TRADE.

A TALK ON FOUNDRY CHEMISTRY*

By H. L. Bowers, Consulting Chemist and Metallurgist

UPON the fact that what is in other metals oftentimes a detriment, in iron becomes a positive blessing, if handled intelligently, hinges the whole subject of foundry practice. Probably no other business has seen so little advance over the conditions that existed forty years ago. Economies and certainties in casting iron should appeal as much to the foundryman as they do to the steel manufacturer. It is very important to the foundryman that he have an intelligent comprehension of the composition of the iron he is receiving.

Grading Iron.

The practice of grading by fracture has in the past been general, but it is unreliable. The grades used in foundry practice are (1) Silicon, 1.75 to 3.50, (2) 2.25 to 2.75, (3) 1.75 to 2.25, (4) 1.25 to 1.75. Practice in some furnaces is to offset high sulphur with high silicon.

Considerable difficulty would arise from such a substitution if the foundry using same did not depend upon chemical analyses to some extent. Oftentimes furnaces running upon bessimer iron have a run of iron high in sulphur, and in order to get rid of it it is run in on the foundryman in small quantities with iron of a better grade. Different furnaces have different systems of grading. What is No. 2 for one furnace may be No. 1 for another and a small foundryman using a grade of iron satisfactory to him may have it called No. 1, while another firm using the same brand may be buying the same grade of iron as No. 1 at a reduction of fifty cents per ton. The composition remaining the same, the fracture may vary. The No. 1 iron of a furnace using one material for pig bed, may be entirely different from No. 1 iron of another firm using a different material for the same purpose. Iron cast in chill molds shows nothing by fracture, besides phosphorus manganese and sulphur influence fracture. Sulphur and manganese may close the grain of a high silicon pig and the fracture of a very high silicon pig is often like that of a low silicon high sulphur pig. Frequently the presence of a high sulphur is shown by the presence of blow holes on top of the pig, but certain conditions may prevent this, so that as a method of determining composition, fracture is no guide. Buying and selling of iron on fracture is rapidly becoming obselete.

Discussion of Impurities.

Carbon may be called the controlling impurity and is of the most importance. Its effect on iron is varied and positive. In foundry iron it may vary from 2 1-2 to 4 per cent. The percentage of carbon determines the melting point of iron and without it the varied degree of strength and hardness could not be imparted to iron. In this respect it acts the same in cast iron as in steel. Free carbon or graphite is really a detriment to cast iron. In general, graphite represents that carbon the iron is incapable of holding in solution when cold. An iron containing no more carbon than it can hold its solution, is a white iron. This is the essential difference between malleable iron and cast iron. In one the essential carbon is burned out, in the other it is forced out and left in the casting. Combined carbon indicates the degree of hardness in iron. Combined carbon increases shrinking. Of two castings of the same composition of different thickness, the thickest will be softer owing to slower cooling and consequent forcing out of combination of carbon, while the shrinkage will be less. The thinner, owing to rapid cooling, holds more carbon in combination and greater shringage results. Carbon lowers the melting point, hence the greater the carbon the lower the shrinkage. Owing to the lower temperature the casting can be poured.

Silicon is not a desirable ingredient of cast iron. The amount of silicon in casting determines the amount of carbon which will be left combined in the solid casting. In other words, the total carbon remaining constant the combined carbon or measure of hardness varies as the silicon. Sulphur, phosphorous and manganese neutralise the effect of silicon. Silicon probably increases the fluid of cast iron and also causes the castings to peel well.

Manganese increases the affinity of iron for carbon, thereby improving the iron through the carbon. Manganese is desirable in heavy casting to about 8-10th per cent. and light casting to about 5-10th per cent. It reduces the affinity of molten metal for sulphur. It closes the grain of iron. One of the greatest difficulties in making stove plate is the necessity for uniform softness. The author here gave an instance of his experience. A casting which polished well and drilled all right in thin sections frequently took the edge off the tool used for milling the outside fitting edges. In other words, the thick portion contained particles so hard that the tool made no impression. At such times the complaint was that the iron contained sand. The analysis showed iron to be normal with the exception of manganese, which ran about 2-10th per cent. and on increasing manganese to 5-10th per cent. the trouble was remedied. The author's opinion is that under certain conditions in the absence of manganese a carbide of silicon or carborundum may be formed in the castings. Probably most foundrymen have had this experience with this so called "gritty" iron.

Phosphorous increases the fluidity of iron and corrects shrinkage and weakens the iron. It will harden iron and must be neutralized by silicon, hence an iron high in phosphorous and low in silicon is valueless for foundry pur- In heavy castings where strength is desired it should be low.

Sulphur combines carbon, erratically causing hardness and shrinkage by closing the grain and weakens the casting. Sulphur has been blamed for much it does not deserve. When the manganese is kept at a proper point there is little fear of sulphur going up to the danger point. The greatest difficulty, however,

* Abstracted from a paper delivered at the annual meeting of the Canadian section of the Society of Chemical Industry at the Engineer's Club Room, Toronto, April 6th.

in sulphur consists in the hard spots which show up when the iron is polished.

Some analysis were then given showing the composition of castings for various works. The actual analysis must be governed by the specifications required.

All efforts may to prevent the contaminuation of iron by sulphur must be directed towards the diverting sulphur from the iron to a slag during the process of melting, as once it has entered the iron it is hard to get rid of it. The percentage of sulphur may be regulated by the use of limestone. The limestone seizes upon the sulphur before it has a chance to enter the iron and is fluxed off. Fluorspar is also reckoned as a desulphurizer.

Other Considerations.

Limestone is generally used as a flux and as it ofttimes contains Fess should be watched carefully. Pig iron is coated more or less with sand and in order to get a free and rapid melting it is necessary to use a basic flux. The fact that lime eliminates sulphur makes it a valuable flux. Magnesia in limestone gives a pasty slag and dolomites should not be used in cupola practice.

Coke needs to be watched carefully as those running much over 1 per cent. sulphur are unsuitable for foundry practice.

Careful foundrymen consider the grade of molding sand. Too great a percentage of loam or lime causes a great loss by burning to the casting. A good sand should run high in silica, low in lime and fusible compounds or minerals. Analysis show Albany sand to contain Single O2, 82.42 per cent. and Hamilton sand 76.54 per cent. The Hamilton sand is a good sand for general work and heavy castings while the Albany sand being high in Single O2 is preferable for light work.

VENTING OF CORES*

By James A. Murphy.

FOUNDRYMEN could base interesting argument upon the subject of the proper venting of cores. Bad venting has always furnished a ready-made excuse for a bad casting by the molder; indeed, when he could think of nothing else to lay the blame on, the core was sure to come in for a bad character and the coremaker's ability was criss-crossed with suitable and expressive adjectives.

Not all molders recognize the degree of skill that is required to vent some

Fig. 1

crooked cores properly, nor do all coremakers realize how necessary it is to have vents through which the gas will flow easily and without any unnecessary obstruction.

The evolution of the air compressor, gas engine and automobile has set the brightest minds in the business experimenting, seeking a remedy for the poorly vented cores that cause such disturbances at casting time. The proper venting of this class of cores is a far more skillful operation than most people are ready to allow, and it is only seldom that the coremaker has the proper facilities to do the job properly. The core shop is the most neglected part of our foundries to-day and it is only within a few years that it has been given any notice at all. It is a hopeful sign of the times, however, to see foremen and employers in general waking up to its necessities and its possibilities.

The pulling of wires and soaped strings around corners as a means of venting is a thing of the past. The wax wire method of venting has come into our foundries to stay. All methods of wax wire venting are not by any means satisfactory.

The wax taper with a string of threads running through it gives very poor satisfaction, that with the wire through it is better, but its cost is an item of no small consideration, and many foundries prefer to do without it and continue to lose casting on this account. The object of using the wax, of course, is that the core while drying absorbs the wax, leaving only the string of wire which, when pulled out, leaves an open and free hole.

If the string gets burned on the end it is a difficult job to pull it, and if it breaks inside the core it cannot be extracted. An imperfect vent is the result and a possible blown casting.

The wax wires, Fig. 1, are the result of much experiment to do away with strings of any kind in the wax, in fact, to have something that was as nearly fool-proof as possible.

The element of cost was also a consideration, and the composition used is made at less than one-eighth of the cost of any wax on the market to-day. The illustration of the machine, Fig. 1, gives

Fig. 2

a fair idea of the process of manufacture. A helper will turn out enough of different sizes in about one hour to last 30 coremakers one day, so the cost of manufacture is infinitesimal, once the installation is made.

These wires are easy to handle, are not sticky except when hot, are as tough as twine when at the right temperature, and can be made in coils of any length or cut off in desirable lengths and laid away in trays ready for instant use. There is no waste, as the pieces not used, short ends, etc., are again put back in the machine and pressed out as new wires.

The thickness is regulated by the die. In practice I make them from 3-32 to 3-8 in., but any desired size can be made. The material is very light and I have known men not to use a pound all day venting the most complicated jacket cores for air cylinders.

Fig. 3

The skill of the coremaker is considerably minimized in producing a perfectly vented core, as it is impossible for him to do otherwise if he rams up a string of this wax in the proper parts of the core. It is not claimed that this

*Read at a meeting of the American Foundrymen's Association.

wax will take the place of rods, but its absorption by the sand in baking has a very decided tendency to strengthen the core.

Several cores that must be made in halves in order to be properly vented can be made in one piece by this process at a considerable saving of time and expense.

Since I designed this machine and brought this method of venting cores to what I consider a state of absolute perfection, in the shops of the Chicago Pneumatic Tool Co., at Franklin, Pa., blown cores are a thing unknown in our foundry where every casting is filled with them and where work of the most intricate character is the rule rather than the exception.

I cannot lay too much stress upon the time-saving qualities of this machine. Venting is at best a tedious and time-killing operation no matter how it is done, but with this wax all that is necessary is to run up the string in the proper place and the job is done permanently and well.

The ingenuity of the most expert designer in producing crooked orifices for which cores must be employed in the production of the casting, is defied, for as long as there is left any opening through which a small pipe can be passed a perfectly vented core can be made by this process.

Several foundrymen who have seen the process in operation have pronounced it one of the most important inventions for the cheap and safe production of intricate work.

Its cost of installation being very small, the cost of the material not worth mentioning, no waste material, the accessibility of all sizes of strings in any quantity at a moment's notice and the perfection of the cores that it is used in, are all points very much in its favor of being later as universally adopted as the core-making machine.

I consider it absolutely indispensable in shops which make a specialty of pump, engine, air compressor, gas engine, automobile or other intricate or delicate work. In several of these shops its savings in the course of a year would run well into the thousands of dollars.

The Making of a Nine-Foot Valve

By Robert Shirley

FOR controlling the flow of water to the turbines of the Ontario Niagara Power Co., at Niagara Falls, Ont., it is necessary to introduce a valve in a 9-foot penstock, and the accompanying illustrations show the method of making the patterns and the molds for these valves. The work was done by the Pratt & Cady Co., of Hartford, Conn. Each one of the gate valves weighs 126,000 pounds, and they are the largest valves thus far constructed. The complete valve assembled on the floor of the shop is shown in Fig. 1, which also shows the gears for the controlling mechanism, which is operated by electricity. The body of the valve on the cars ready for shipment is shown in Fig. 2, and this view gives a very good idea of the size of the pieces and the rigging of the castings.

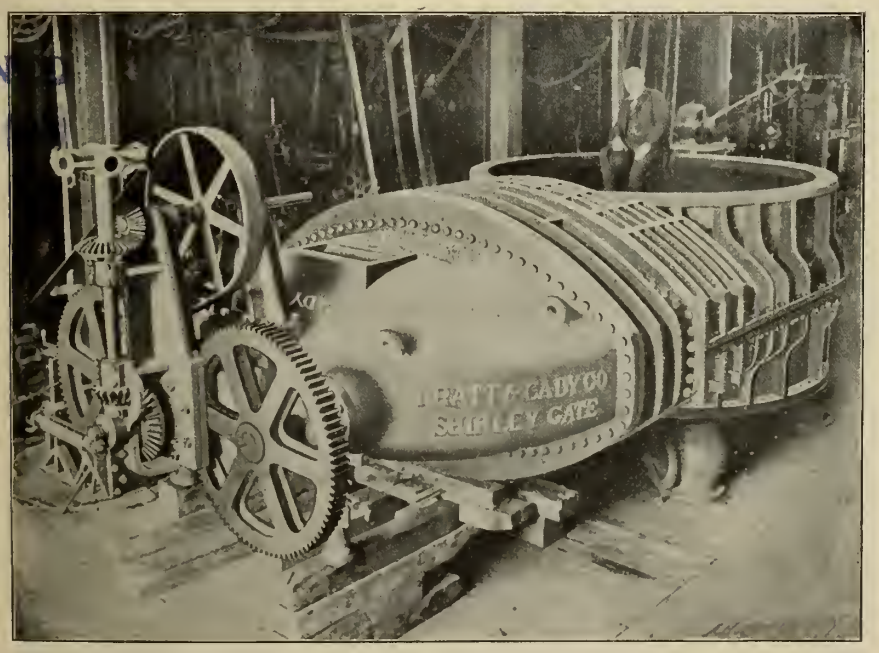


Fig 1—The Finished Valve

For turning the circular portion of the pattern a regular Fay & Scott lathe was used, which was built to swing 66 inches over the gap in the bed, but as some of the pieces were 132 inches in diameter, it was necessary to turn the head around and raise it 20 inches. The head was raised to save cutting a hole in the pattern shop floor. The chuck used in turning the work was the large iron chuck furnished with the lathe, to which a wooden face-plate is attached.

A drawing of one-half of the valve body is shown in Fig. 3. The location of the ribs can be very plainly seen. The body was made in halves so as to

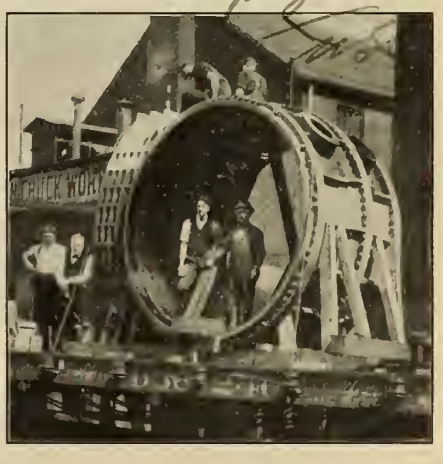


Fig. 2—The Valve Body

leave its own core, with the exception of the internal ribbing, which was taken care of by dry sand cores. The horse shoe-shaped flange, (A), which is located at the middle of the valve, was made first as a foundation upon which to build the pattern. The drum of the body was next turned up and placed in position at the circular end of the horseshoe-shaped flange.

The flange (B) was cut out on the inner side to conform to the shape of

the outside of the valve body or neck of the valve, and was then placed in position. Staves were carried from the neck flange to the drum of the valve and made fast there. This gave the outline of the valve body. The outside ribbing was then put on over the staves and made fast by screws from the inside. The ribbing was also fastened together, so that it would be drawn from the mold in one piece.

The valve was molded with the round flange down. The sides forming the body or neck of the valve were so located that one came under each rib, as indicated by the dotted lines in Fig. 3. This left a space between the ribs so that the molder could ram down between them and secure each pocket as he went along. The annular flange was made in sections so that it could be drawn in after the pattern had been drawn from the mold. These sections were also screwed firmly in place while the mold was being rammed up on the outside.

Before the inside of the mold was

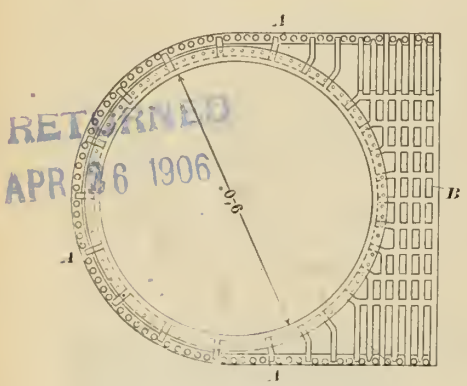


Fig. 3—Drawing of Valve Body

rammed up all screws were removed, both from the ribbing and the circular flange. A plate which had been previously prepared to carry the prints for the inside pocket cores was then put in place, all of the prints on the plate were numbered and the cores numbered to correspond. This was done to facilitate setting the cores and to avoid mistakes in the foundry. The prints were all put on with dowel pins so that they come away with the cope, thus leaving the mold free to be dressed. After the pattern was drawn (the inside of the ribs conforming to the outside of the body), all that was necessary was to scrape off the superfluous sand to the level of the ribs and the inside core gave the required thickness of metal.

The general construction of the valve bonnet can be seen by referring to Fig. 4. The bonnet was made in green-sand with a dry-sand core. The pattern was made as though it were expected to leave its own core, and the interior of the pattern then used for a core-box. This was done to save the expense of making a core-box. The dotted lines below the upper right-hand view in Fig.

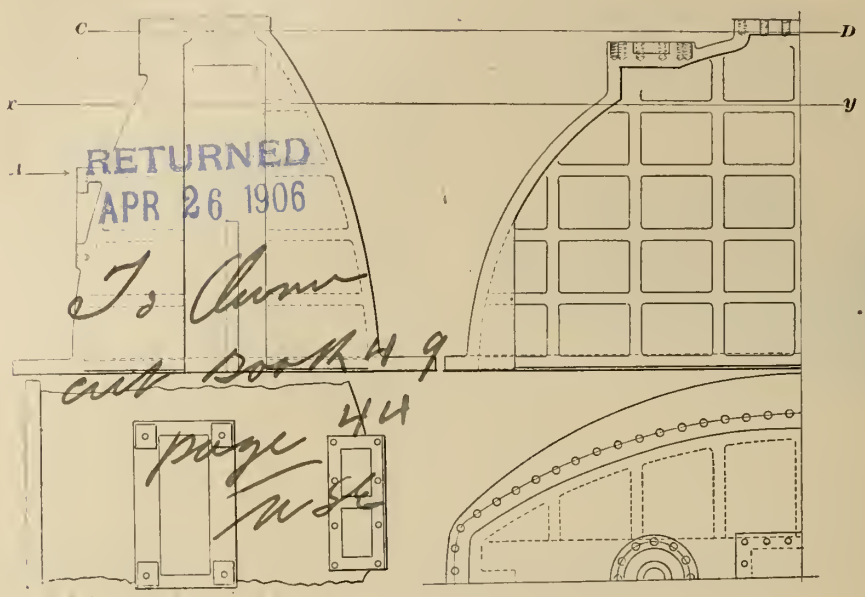


Fig. 4—Section of Valve Bonnet

4 show the print that was fitted into the bonnet when it was used as a pattern, also the corresponding piece which was fastened by pins to the flange of the bonnet when the pattern was used as a core-box. By this device the core was made to fit the prints.

In making the core the pattern was set on a cast-iron plate. The top part of the pattern was made with a joint on the line (x-y), so that the upper part could be removed. This provided ample room for a man to work inside. The inside ribbing was all made in separate pieces, and before the core was rammed up all the pieces except the bottom longitudinal ribs and the first row of the vertical ribs were removed. The sand was then rammed to the top of the vertical ribs, scraped off flush, and the second set of longitudinal and vertical ribs screwed in place, when the ramming proceeded as before. This continued until the line (x-y) was reached. The top part of the bonnet was then replaced upon the pattern, being guided in place by dowel pins. The cap above the line (C-D) was then removed, thus providing ample room for ramming up the top part of the core. The screws holding the various ribs in

Fig. 5—Mold and Core for Body Extension of Valve

Fig. 6—Mold Ready for Cope

place were then taken out and the pattern lifted off. As the ribs were withdrawn from the core the recesses formed were filled with blacksand to prevent the sagging of the pockets. The core was then ready for drying.

The greatest possible amount of care was taken in the pattern shop to avoid mistakes in the making of the various patterns required for a valve of this size, and the results were very successful.

As has already been stated, the valve body was made in two parts, which were bolted together at the centre. This body is heavily ribbed both inside and out and hence it is a very delicate piece of work for the foundryman. A view of the mold for one-half of the body is shown in Fig. 6. A large central core is nine feet in diameter, and both the core and the mold are of green-sand. After the pattern is drawn the central core, which is made on a plate, is removed to permit the proper dressing of the mold. As the mold is made in a pit in the floor the only rigging necessary was a plate for lifting the core and a flask for the cope. The rib pockets in the drag, being of green-sand were all securely rodded. The rib pockets in the cope were a much harder proposition to handle and hence were made with dry-sand cores which were tied in place in the cope. Every point and every core was numbered to facilitate the setting. The cope with all its cores in place weighed about 35 tons.

The mold for one of the distant pieces for the throat of the valve is shown in Fig. 5. The piece is also called a body extension. The mold is of green-sand and the picture was taken just as the dry-sand core was about to be lowered into place. On the right side of the picture is John Wuseh, foreman of the foundry, and on the left of the core Edward Mullhouse, assistant foreman. The pockets in the core are very deep and hence considerable care had to be taken in drying to prevent them from sagging.

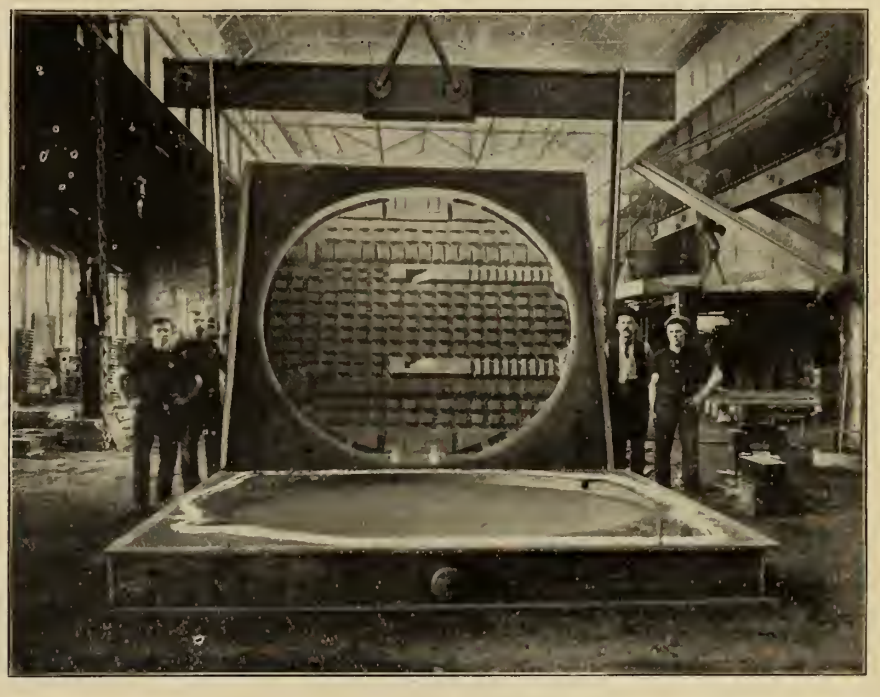


Fig. 8—The Mold for Valve Gate

Fig. 7—Mold of valve Bonnet

The mold for the valve bonnet is shown in Fig. 7. The drag is made in a pit, and in the illustration a dry-sand core is shown in place. The flask upon the lower flange of which the men are seated is the cheek. It was impossible to get a view of the inside of this part of the mold.

A view of the mold for one of the gates is shown in Fig. 8. The face side of the gate is in the drag to insure a good clean surface for the reception of the brass seat rings.

For the reproduction of this article and for the use of the illustrations Canadian Machinery is indebted to the courtesy of Wood Craft, Cleveland, Ohio, in the columns of which it originally appeared.

Making a Pair of Involute Gears

By John Carr, Hamilton

A DESCRIPTION of work actually done and method of doing same is probably more interesting to most readers of Canadian Machinery than theories and formulas. While theories and formulas are necessary, the practical application of those theories and formulas is vital to the success of any department of mechanics.

The pair of gears described were made for the London Machine Tool Co. for heavy punch. The large gear has 55 teeth, small gear 16 teeth. Shape of teeth involute 15 degrees. Both gears are shrouded to within $\frac{1}{8}$-inch of pitch line. Pitch 1.25 diametral. Web of large gear 2 inches thick. Rim 2 inches thick. Face of teeth 6 inches. Shrouding flange 1 inch thick. Four-tooth clutch on one side of web. Hub 16 inches diameter. Bore 7 inches.

Web was built of two layers, grain of wood running toward centre. Rim built up in segments as shown in Figure 2, all joints being lapped. The shallow hub with clutch fastened permanently at centre, binding centre of web together. This hub turned up with web, teeth of clutch worked out and planted on separately. On reverse side one piece 1 inch thick was fastened in centre to make large fillet where the hub joins the web. The body of hub was built up in segments and head let in; this hub left loose to lift off with cope when molding, and kept in position by brass dowel pins. Shrouding flanges were built up in three layers of segments and fitted with brass

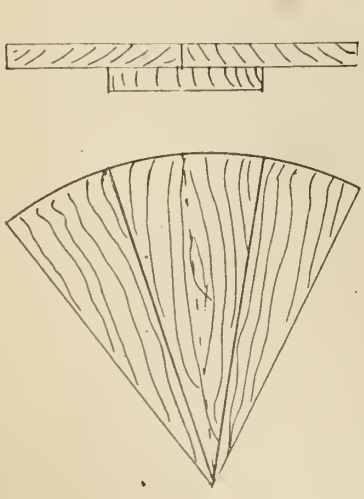


Fig. 1.

dowels, both flanges being left loose to give molder opportunity to watch teeth when drawing pattern out of sand. Never depend upon two layers of segments for a pattern you wish for permanent use; it will not stay straight.

Teeth for these gears were cut in a box, the curves of box having been made to template taken from drawing; one end of box made slightly smaller than other to allow for draught. The rim was divided accurately and teeth set to

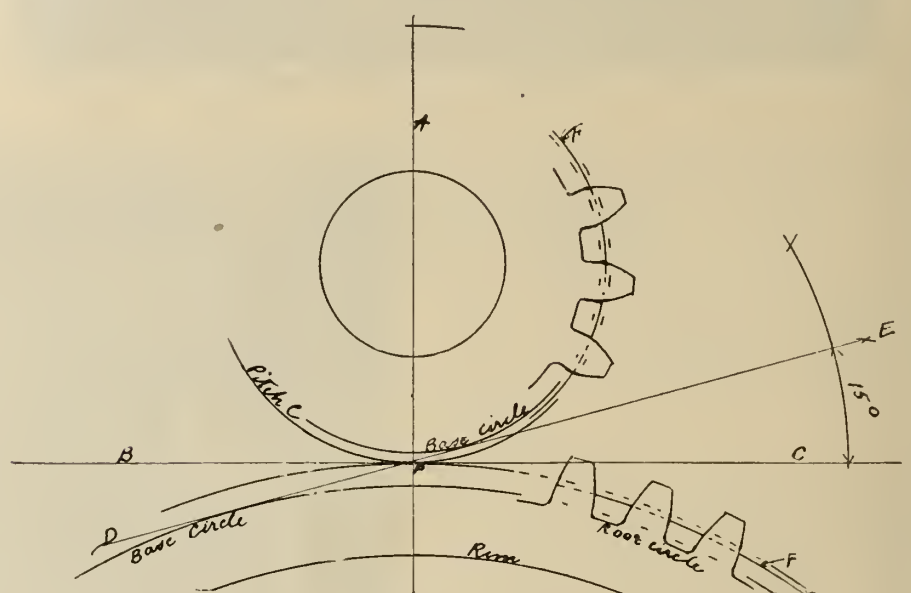


Fig. 3.

line, then screwed in place through rim. The gears were laid out as shown in Figure 3.

(A) is a line passing through centres of both wheels. (P) is the point at which pitch circles meet. Through this point line (B C) is drawn at right angles to (A). Pitch circles determined by formula are also drawn through this

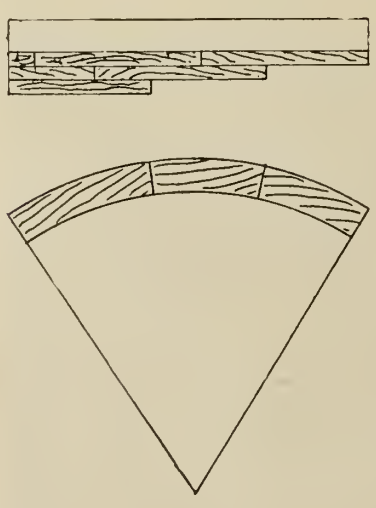


Fig. 2.

point. Through this same point is also drawn the line of obliquity in this case fifteen degrees as shown (D E). From centres of gears base circles are drawn touching this line, templates being made to these base circles. The involute curve is drawn mechanically by unwinding a string off templates, template being tacked in proper position on drawing. Tooth is completed inside base circle by drawing radial lines to root circle. When one tooth of each gear is completely drawn, templates are made exact to drawing, from which templates shape of boxes for working teeth are cut. Small leather fillets were run in at roots of teeth. The circular pitch being coarse about two and one-half inches, three-sixteenths clearance was left on pitch line, also in depth of tooth.

Formula, large gear.—To find pitch dia. $55 \div 1.25 = 44$ ins. To find outside dia. $(55 + 2) \div 1.25 = 45.6$ ins. To find circular pitch $44 \times 3.1416 = 138.23$ ins.; $138.23 \div 55 = 2\ 513$ ins.

Formula, small gear.—To find pitch dia. $16 \div 1.25 = 12.8$ ins. To find outside dia., $(16+2) \div 1.25 = 14.4$ ins. To find circular pitch, $12{,}8'' \times 3.1416 = 40.212$ ins.; $40.212 \div 16 = 2.513$ ins.

Three rapping plates were let in on cope side and three draw plates threaded five-eighths on under side of web. Finished with three coats black shellac,

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There is always a best way of doing everything, even if it be to boil an egg. Manners are the happy ways of doing things; each one a stroke of genius or of lo e, now repeated and hardened into usage.—Emerson.

It would be an unspeakable advantage, both to the public and to the private, if men would consider the great truth that no man is wise or safe but he that is honest.—Sir Walter Raleigh.

Driving Gear for Wood Planing Machine

By T. C. Robertson.

THE power required for the feed of wood planing machinery is somewhat difficult to determine, owing to the variety of work done on a single machine. The speed per minute may vary from 10 to 80 feet, and the amount of resistance offered may admit of almost as great variation. The only safe method of design is to take the maximum load, and this is a matter of considerable difficulty, as the conditions vary so much that only experience can fully determine what is reliable.

In order to obtain pulleys, gears and shafts of sufficient strength it is, perhaps, the best way to begin with the size of belt used, and this has been pretty well established by experience on the different types of machines. The greatest possible power delivered by the feed belt will determine the proportion and strength of machinery leading up to feed rolls. We will take, for example, the case of a planer and matcher with four cutter heads, say top and bottom head 15 in. long, side heads 6 in. long.

Referring to diagram, we will take power from countershaft which makes 900 revolutions per minute. On this shaft is mounted a pulley (A), driving on pulley (B). On the end of shaft on which (B) is fastened there is a pinion (C), geared into a larger wheel (D), mounted on intermediate shaft containing another pinion (E), which is geared to wheel (F), fastened to feed roll which acts upon board being fed through. This completes train of gearing from countershaft to feed roll.

Having determined feed roll to be 9 in. diameter, and rate of feed per minute to be about 50 feet, we find that roller must make about 20 revolutions per minute. In the present example we obtain pulleys 5 in. and 18 in. diameter; two gears 18 in. and 20 in. diameter, and two pinions 5 in. and 6 in. diameter on pitch line.

As we must find a basis of calculation, this is best obtained by finding horse power of belt, which we find by following rule $H\,P = \frac{V \times B}{800}$ in which V = velocity, B = breadth 4". As the countershaft makes 900 revolutions, and pulley is 5" diameter, velocity would be

$\frac{900 \times 5 \times 3.1416}{12} = 1178$ feet per minute,

$\frac{1178 \times 4}{800} = 5.79$, say 6 H.P. Let us now obtain revolution at which gears and pulleys revolve. A = 900 revolutions, B and C $\frac{900 \times 5}{18} = 250$ R.P.M.; D and E $\frac{250 \times 5}{20}$ = 62.5 R.P.M.; F and G $\frac{62.5 \times 16}{18} = 20.8$ R.P.M. of feed roll.

We here must recognize a well-known mechanical principle that the slower the movement by which any given amount of energy is transmitted the greater must be the strength with which the moving parts are constructed. Gears (F) and (G) must therefore be the strongest in the train. In order to obtain load on tooth of gear it will be necessary to find lienear velocity of roller on which gear is attached.

$20.8 \times \frac{9}{12} \times 3.1416 = 49$ ft. per min., say 50 ft.

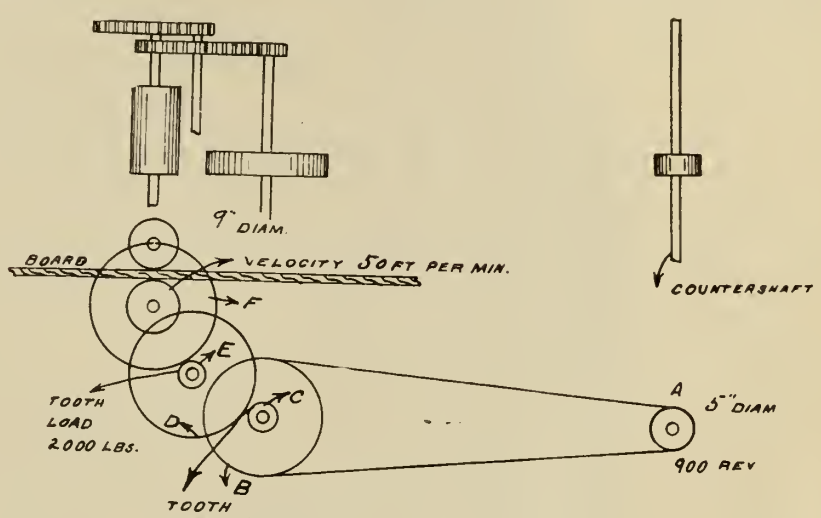


Diagram showing Train of Gearing.

6 H.P. = 33000 × 6 ft. lbs. per min. Velocity of board 50'; pull on board $\frac{33000 \times 6}{50} = 3960$, say 4000 lbs.

The load on tooth of F and E $= \frac{4000 \times 9}{18}$

= 2000 lbs. load on C and D $= \frac{2000 \times 6}{20} =$ 600 lbs. = total load.

The next step will be to determine proportion of gears E and F. Lewis' well-known formula will give us pitch—from which other parts are proportioned—as follows: W = 3 P' F Y, in which W = 2000 lbs. in present example S = 8000, or safe working stress at 100' per min.; for cast iron F = face of gear which we will assume to be 2¼", Y = factor of strength for 15° involute number of teeth we may assume at 54.

$Y = 0.124 - \frac{0.684}{54} = 0.124 - 0.0127 = 1113$

2000 lbs. $= 8000 \times P' \times 2\frac{1}{4} \times .1113 -$

$P' = \frac{2000}{8000 \times 2\frac{1}{4} \times .1113} = \frac{1}{1.0017}$

Approximately 1" pitch nearest circular pitch = 1.0472, corresponding to 3 diametrical pitch; number of teeth = 3 × 18 = 54 which corresponds to diam. required. Proportion of teeth may be obtained from pitch as described in Brown & Sharp's catalogue, or from article in Canadian Machinery of May, 1905.

The load on gears (C) and (E) is lighter and may be worked out in similar way, giving approximately 4 diametral pitch.

It should be observed here that pinion (E), if cast iron, is the weakest wheel, owing to teeth being somewhat undercut. If steel is used in pinion (S) would equal 20,000, in which combination the wheel (F) is the weaker and would therefore be the measure of strength. In calculationg size of shaft on which roller is mounted we have a more difficult problem, as twisting and bending moments enter into it. For the present example we may be safe in using a simple formula if the gear is kept close to bearing to avoid excess of bending strain:

$$D = \sqrt[3]{\frac{P\,L}{K}}$$

in which D = Diameter in inches, P = twisting force for cast iron 2000 lbs., K = coefficient value 1700, D = length in inches (9")

$\frac{2000 \times 9}{1700} = \sqrt[3]{10.6} = 2.15$" approx.

Card Index for Follow-Up System

By W. H. Stevens.

UNLESS you catch the apples as they fall it is useless to shake the tree.

Just so, unless you are prepared to follow up each enquiry received, you may as well not advertise. If but a few inquiries are being received, one may manage to follow them by recording in a book, or by keeping all the letters, reports, etc., together, and apart from other letters, until the matter is settled. But with constant inquiries, the task of following these by such cumbersome methods is so great, that only very important matters are likely to receive proper attention and that only with a large amount of work, while a large portion of advertising results is wasted.

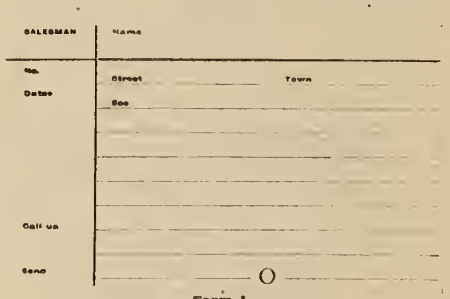
With the card system any requirement may be met, large or small, simple or complex. The following suggestion from systems actually in use, both in its entirety and in its various parts, may be of service, but of course must be suited to conditions wherever adopted.

An inquiry is received. A card or slip about 5 in. x 3 in. (larger if necessary) see form 1, is made out by clerk, (in duplicate if desired) containing name, address, correspondence number, and any particulars desired, also a note of the inquiry and reply. This is filed in a diary tray, vertically, wherein are cards called guides, having projections for months on one color, and for the days of the month, 1-31, on another. If your reply or quotation is dated say the 20th, place the card behind the guide card for the 23rd or 24th, or as far ahead as you wish to allow for an answer. When that day comes, if an order or reply has not been received meanwhile, write again and note on the card, putting it forward in the tray. If

Cabinet for Index

you have a traveler to assist you by calling, a duplicate of this report is handed him with instructions to call. He reports his call on a similar slip, a pad of which he carries in a small leather cover, while he retains a carbon duplicate for his further use. All these slips should be clipped together, and moved forward as the matter is followed, until a definite result is obtained.

It is often desirable to have at the same time an alphabetical index of these inquiries. In this case two methods are used; one, a duplicate or report slip is made out with carbon and filed alphabetically; but while this gives the result with no extra writing, a large number of slips accumulate, making quick reference difficult and taking extra space; the other way is to make out a card (see form 2) showing any particulars desired (i.e., credit, payments, statistics, customers' requirements, etc.) and a note of the inquiry and your reply. When another report or letter is received, this is entered on this card. By using both sides of this card, from 10 to 30 or more brief reports may be

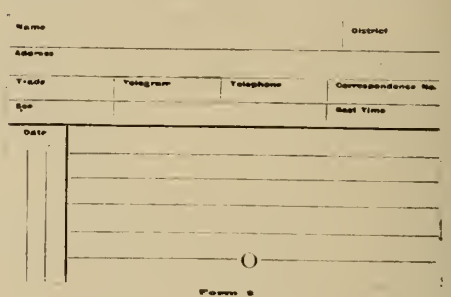


Form 1.

entered on one card, and thus the whole record may be quickly referred to by a principal.

All letters written or received which require entering on this alphabetical list, are stamped "Report" by the one who opens or writes the letters, and the correspondence clerk (or other clerk to whom the work is assigned) makes out a report. This is entered on the customers' alphabetical list and then placed in the diary tray. If the vertical numeric filing system with separate copies is used, the correspondence number is put on the slip and then on the alphabetical card when first made out, and is then convenient for reference from these lists without looking in the correspondence index. Since by this arrangement the letters are filed away at once, they are always ready for immediate reference by anyone requiring them, and not side tracked or kept out by manager or other official, causing great inconvenience to anyone wanting such letters.

The traveler may, with advantage oftentimes, have a diary tray and a list of customers also, and form 2 may serve for both—the traveler himself entering reports of his calls on his customers'



Form 2.

card and of letters which the clerk reports to him, following these up by means of the diary. When not in use they are filed by district, so at any moment he may have together all the cards in one town.

When it is necessary the alphabetical customers' list may be classified automatically in a variety of ways, i.e., in different colors for different classes of trade, or if such classifications are more than four or five a small tab on the card in different positions shows this classification more easily. A tab card is sometimes used to distinguish between prospective and actual customers, the tab being cut off when an order from the prospective customer is received, or the prospective and actual customer may be in two separate lists. Again, by use of cards with 12 or 15 tabs on each, each tab may indicate a different product. If a circular relating to one of these products has been sent out the tab representing that product may be marked, and when the order is received, the tab would be cut off, showing at a glance what circulars had been sent and what products supplied to each customer.

FORESIGHT

Foresight is a little-discussed virtue, though it is a fundamental one. The habit of looking ahead has made many lives successful. Lack of this same quality has turned hundreds of shiftless, improvident persons upon the world.

* * *

No matter if you are hidden in an obscure post, never content yourself with doing your second best, however unimportant the occasion.—Genl. Phil. Sheridan.

The Late John Bertram

CANADA'S FOREMOST MACHINE TOOL MANUFACTURER.

" Though old, he still retained
His manly sense and energy of mind.
Virtuous and wise he was, but not severe,
He still remembered when he once was young."

WHAT the name of Carnegie is to the iron and steel trade of the United States, and that of Edison or Westinghouse to the electric and allied industries, so has the name of John Bertram, of Dundas, been to the machine tool interests of Canada. From the quiet serenity of a peaceful old age and the fruitful enjoyment of the success of a well spent life, John Bertram was called suddenly as he was preparing to leave his residence for his office on the morning of April 4. Without a moment's warning the summons came, causing sorrow, deep and lasting to his immediate family and friends, and regret, genuine and sincere, not only to his fellow townsmen, but to the entire manufacturing interests of the Dominion. While the name of John Bertram will live in the large and important industry that bears his name, those who knew him personally will cherish his memory on account of his attractive personality, rather than as the man, who, more than any other, made the name of his adopted town known from the Atlantic to the Pacific or the man who stood the test as a captain of industry or as a leader of men.

The late John Bertram, of Dundas, Ont.

To be respected and esteemed is given to many, but to stand in the fierce light that beats upon a man in an exalted position and be beloved by all, comes to few, but such was the case with the late Mr. Bertram. The silent music of his life, his bright blue eyes, clear complexion, the native Scotch accent, his kindly smile and fatherly interest in others, all united in drawing men to him and made him one who touched the inner lives of his fellows. While genius was in his make up, energy, perseverance, courage, and integrity were the dominant qualities that after his landing in Canada were to win the name and fame that came to him and that placed him in the forefront of the machine tool trade of the Dominion.

On Sept. 13, 1829, John Bertram was born at Eddlestone, Peebleshire, Scotland, his ancestors being pioneers in the millright industry in the south of Scotland. Until fourteen years of age he attended the parochial schools there and during that time he received his first inspiration in mechanics in operating a foot lathe belonging to his grandfather. He soon became an expert turner and was a great favorite amongst his classmates whom he kept supplied with spinning tops or peerics, as the boys called them. In his fourteenth year he moved with his grandfather to Galashiels, a town celebrated in that day for the manufacture of tweed cloth. After two years attendance at school there he became an apprentice with his uncle, Thos. Ainers, of the Waverley foundry.

The life of an apprentice in those days had few of the attractions of to-day. The time to be served was five and a half years and the remuneration during the entire period was six shillings a week. Besides this, the work carried on in the early forties was not easy. If the aspiring young machinist, whether from necessity or principle, refused to pay his footing (which meant a glorious time in some public house) it was counted against him. He dare not give any opinion on a mechanical subject, and high words and worse were his common lot. Happy was the apprentice who had the grit to stand his ground or hit back if required and consider it as the general order of things. When young Bertram suggested to a journeyman

an improvement in the shape of cutting tools instead of the old grubo hoes, the latter stopped, amazed at his impertinence, and said: "Johnny, when you are a journeyman you can shape your cutting tools as you think fit, but don't dictate to me."

In later years Mr. Bertram felt that life in his youth was in one sense a good training school, as he always profited by the mistakes of his elders and never harbored any hard feeling, for in four years he found his place and was able to exercise his own judgment.

The machines in the shop where his apprenticeship was served were of the most primitive type, the lathes had wooden shears and turning was done with slide rests. The proprietor, a skillful engineer, was determined on a change, and installed a set of lathes with ponderous iron frames set upon heavy stone foundations. They were powerfully geared. This change was justified on account of the future class of work which was made a specialty by this establishment. The class of machinery made until this time was textile machinery, such as carding, spinning and the complicated machines required for producing the fine woollen tweeds which have made a world-wide name for this district. Mr. Aimers decided to drop out of the competition with English makers of textile machinery and confine himself principally to steam engines, water wheels, shafting and gearing, as at this time a large number of factories were built on the Tweed and its tributaries. In this class of mechanics the young apprentice had good scope for his ability and made many improvements on machine tools and appliances.

Like all imaginative mechanics he had a hobby, and being always attracted by electric science, in 1848 he spent his spare evenings constructing a direct current machine. In partnership with a brother workman, they prosecuted this hobby for a time, but his friend became alarmed when he saw the expense and realized what lay before him, and withdrew. So Bertram plodded on alone, constructed a machine for insulating the wire, which completed over one hundred feet every evening and finished his electric machine in a few months.

In May, 1852, Mr. Bertram entered married life, taking as his partner, Elizabeth Bennett, fron Roxboroughshire. About that time he made up his mind to come to Canada and with his young wife he set sail from Glasgow on a barque of 1,000 tons register, belonging to the Allan Co. A few weeks before landing a large part of Montreal city had been burned and presented a desolate appearance, so they decided to go to Toronto, arriving in the city by the steamer New Era on a beautiful morning. To use Mr. Bertram's own words, "Dressed in our Sunday braws, we stepped on the wharf at the foot of Young street. There was no esplanade, no railway and none of the landmarks that characterize the city to-day, and Toronto did not look very inviting at that time. While looking at the novel surroundings, so unlike the Broomelaw pier, our appearance attracted the attention of Mr. Duff, of the Inland Revenue Department, who was watching the arrivals. He came up and asked us where we came from and, finding I was a machinist, said: "'Go straight to Dundas and you will find a situation in the John Gartshore foundry.' Dundas? Dundas? I inquired. I never heard tell of it. 'Well,' said Mr. Duff, 'continue on the boat to Hamilton and you will find Dundas.'"

The manager of Gartshore's foundry was the late Willian Gill, Esq., a Galashiels' engineer and well known at that time to Mr. Bertram, who was immediately engaged. The tools here were of a very antiquated pattern, except an American lathe, charge of which was given to Mr. Bertram. It had no changeable feed and required fifty turns of the work for one inch of traverse. The mechanical genius of the man exhibited itself here and he immediately set to work to put a variable speed on the lathe and so doubled the output. At this time these works were building the engines for the steamer "Queen of the West," and latterly the first engines of the Hamilton water works, of which a large part of the work was machined by Mr. Bertram. During these years not only was his inventive ability given scope, but also the development of a keen business sense was begun.

In 1865 he joined partnership with Robt. McKecine under the title of McKecine & Bertram. This business was carried on for twenty-one years and when the senior partner retired it was continued as John Bertran & Sons and later incorporated as a joint stock company. During all this time new lines were being constantly added to the output, improvements made in existing methods and business reached out after from ocean to ocean until the firm became the best known of its kind in the country. Last Summer the business was incorporated with the Niles-Bement-Pond Machine Tool Co., the largest builders of machine tools in America, having the parent Niles works in Hamilton, Ohio, the Pond works in Plainfield, N.J., the Bement works in Philadelphia, as well as the electric crane department.

During his many years residence in Dundas the late Mr. Bertran was one of its foremost citizens and exercised a keen interest in promoting its welfare. He was a councillor for many years and held the offices of reeve, deputy reeve and mayor. In religion he was a Presbyterian and in politics a reformer.

Mr. Bertram's wife died about two years ago, the family surviving including four sons and one daughter—Henry, Alexander, Dr. T. B. and James B., of Dundas, and Mrs. Dr. Stirling, of Picton.

From the strenuous activities of his business life Mr. Bertram found time for deep and extensive reading as well as leisure for several trips to his native land. Only a few days before his death as he sat smoking his pipe in his office and growing reminiscent over the changes that had been wrought since his young manhood, he related to the writer an incident on one of these trips which showed the thoroughness of the man. One of hs early undertakings, after learning his trade, was the building and installing of a water wheel, after many weeks of laborious work. Forty years afterwards he visited the mill where the wheel had been placed. He found that it had been running continuously for the operation of the mill during that period, was then running and during all those years had never cost a shilling for repairs.

He dearly loved to delve into the histories and mysteries of earlier civilizations and on the subject of recent archaeological discoveries he was an authority. The Bible also was a feature of his reading, as his intimate knowledge of its contents revealed. Natural science was all absorbing, resulting in a deep insight into several of its branches.

Despite advancing years he kept in close touch with business matters as well as the general affairs of current history, and was keenly alive to the industrial changes and the advances that succeeding years have brought about.

Practical Questions and Answers

Reasons for Compounding Steam Engines.

Ques.—Wherein is the efficiency of an engine increased by compounding?

Ans.—The thermal efficiency of an engine is represented by the formula

$$E = \frac{T - T'}{T}, \text{ where } T =$$

temperature of steam upon entering the cylinder and T' is the temperature of the exhaust steam. It is quite apparent, therefore, that the thermal efficiency of an engine can be increased by increasing the difference between T and T'. The lowness of the temperature of exhaust is limited by the efficiency of condensation. A temperature of about 110 degrees F. is as low as can be obtained with most condensers. Thus T' is limited to 110 degrees F. Thus the tendency for some time has been to raise the boiler pressure and thus the initial temperature T. However, as the difference between T and T' increases the cylinder condensation increases because of the great range of temperature through which the cylinder has to pass. It was to overcome this that compounding was introduced. In the single cylinder the live steam enters, and there is a certain amount of condensation occasioned by the low temperature condition left by the previous exhaust. After cut-off the pressure gradually falls, and as it does the latent heat in the water converts it into steam again under the lowering pressure. At exhaust this steam leaves the cylinder with the rest and is lost.

In the compound engine the expansion and thus the temperature range is divided into two or more parts, each part taking place in a separate cylinder. In the first cylinder the same thing goes on as was described for the single cylinder, except that the ratio of expansion and thus the change in temperature is one-half, one-third or one-fourth as the case may be, but the re-evaporated condensation, together with the rest of the exhaust steam, instead of exhausting into the atmosphere passes into the next cylinder where the heat units are further utilized. In the last cylinder condensation takes place as in the other cylinders, and at exhaust the water is re-evaporated by its latent heat and passes out and is lost in the same way as it is in the single cylinder. However, the amount of condensation is much less in the last of the compound cylinders than in the single cylinder because of the much smaller range of temperatures. Thus the thermal efficiency is increased by compounding because of the decrease in condensation losses.

There is another advantage of compounding which applies only to large units. By increasing the number of cylinders it is possible to distribute the torque, and that is an important consideration in units of large power.

It might be said here that the term "compound" is properly applied to any number of expansions, although it is commonly restricted to a consideration of two expansions, the terms "triple expansion" and "quadruple expansion" being applied to three and four expansions respectively.

* * *

The Efficiency of the Injector.

Ques.—Is the injector an efficient agent for feeding water to steam boilers?

Ans.—Considered from one point of view the injector is a perfectly efficient agent in steam boiler feeding because it has a thermal efficiency of nearly 100 per cent., the small loss being due to radiation. The steam mingles with the water and is condensed, but the entire heat energy of the steam, less the small amount lost in radiation, is carried back to the boiler by the feed water, the heat due to friction in the injector even being reclaimed and carried back to the boiler in the feed water.

But the practical objection to the injector in a good many cases is that the injector can feed only comparatively cold water because the efficient operation of the injector requires that all the steam must be condensed by the water supply, and as the temperature of the water supply is increased the amount required will be increased. In very few injectors is it possible to use a feed-water temperature above 130 degrees F.

This limitation is a decided disadvantage to the injector where exhaust steam might be used to heat the feed water.

* * *

Meaning of Vacuum in Inches of Mercury.

Ques.—What is meant by the expression "a vacuum of so many inches of mercury," and how can it be changed into pounds per square inch absolute?

Ans.—If we take a long glass tube, insert one end in a bowl of mercury, and connect the other end by means of a piece of rubber tubing to an exhaust pump, and partially exhaust the air from the tube, the mercury will rise in the tube until equilibrium is again reached. That column of mercury in the tube is held up by the excess of the atmospheric pressure over the air pressure on the top of the column. Thus it is possible to express the degree of vacuum in the glass tube by the height of the column of mercury held up by the excess of the atmospheric pressure over the absolute pressure in the tube.

To change this expression for a degree of vacuum into pounds per square inch absolute, it will be convenient to take a specific number, say 8 inches of mercury. Then the difference between atmospheric pressure per square inch and absolute pressure per square inch of the vacuum will be the weight of a column of mercury 8 inches high and 1 square inch in cross section, i.e., of 8 cubic inches of mercury. One cubic foot of water weighs 62.35 lbs., and the specific gravity of mercury is 13.58, and thus the weight of 8 cubic inches of mercury is:

$$\frac{8}{1} \times \frac{62.35}{1728} \times \frac{13.58}{1} = 3.9 \text{ lbs.}$$

Atmospheric pressure is 14.7 pounds per square inch absolute, and thus the absolute pressure of the assumed vacuum of 8 inches of mercury is $14.7 - 3.9 = 10.8$ pounds per sq. inch.

* * *

Reason of Boiler Corrosion

Ques.—Do other causes besides mere hardness of the feed water tend to make the metal in contact with the water in boilers corrode?

Ans.—Methods of water purification usually carried on tend to concentrate the solutions of any impurities in the water and cause more corrosion. For instance, a residue of sulphate of soda is usually left in the water. As this becomes more and more concentrated it attacks the boiler and gives trouble at times when the corroding is known to be going on and yet the real cause of it not understood. Again, nitrates and chlorides are even more corrosive than the sulphate. Chloride of magnesia is the worst enemy the metal of a boiler has to contend with when it is present in the water. To avoid corrosion from these causes it is necessary to keep the concentration below the point where the salts will attack iron or steel. Since the water in the boiler will not be uniformly mixed, the concentration is apt to be a maximum where the evaporation is greatest or at a point of greatest heat in the boiler, and these points are likely to be the first attacked. It has been recommended that a boiler be emptied once a week and thoroughly washed every two months in order to avoid the accumulation of these soluble salts.

Power and Transmission

Steam *Gas* *Electricity* *Compressed Air* *Water*

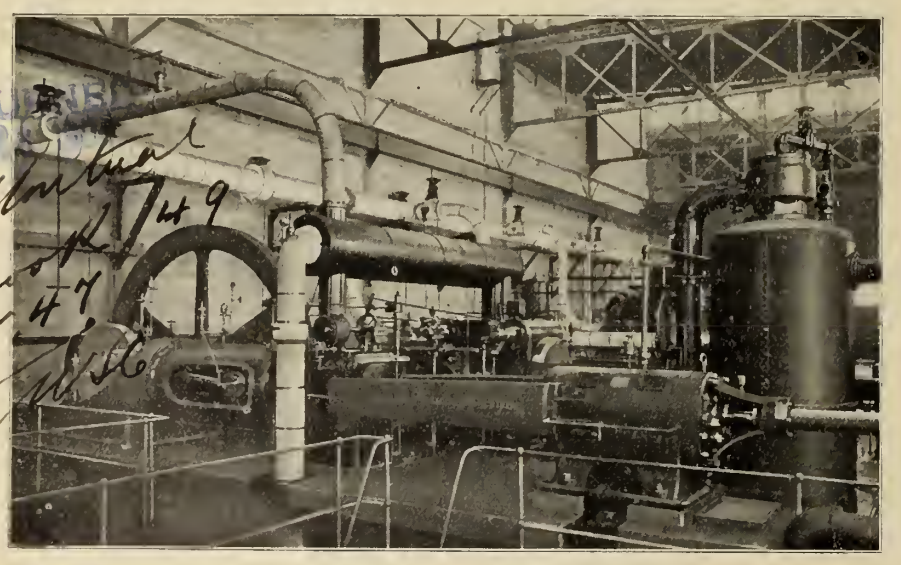
LARGE COMPOUND AIR COMPRESSOR.

A LARGE air compressor in the powerhouse of the Canada Car Co., Limited, Montreal, is illustrated herewith. It is a Corliss cross compound steam and compound air type and was built by Allis-Chalmers-Bullock, Limited, of Montreal.

The compressor is designed to stand a steam pressure of 190 pounds at the throttle of the high pressure cylinder. The steam valve gear is of the standard Corliss release type. The governor is of the improved fly ball type, regulating the valve gear of the steam cylinder and capable of speed adjustment by means of a lever and adjustable weight for at least five revolutions above and below normal speed. The governor is furnished with an air regulator attachment operated by pressure from the air receiver and so controlling the steam cut-offs independently of the action of the governor balls that the speed of the compressor will vary automatically in proportion to the amount of air required.

The air cylinders and heads are thoroughly water jacketed. The air inlet valves are of the Sergeant patent piston inlet type and the discharge valves of the improved poppet pattern. A vertical receiver intercooler stands between the cylinders and is 8 inches in diameter by 13 1-2 feet high, with tinned brass tubes through which the cooling water circulates. It is shown at the right in the illustration. The receiver is situated in the basement beneath.

The steam cylinders are 16 inches and 32 inches in diameter and the air cylinders 18 1-4 and 30 1-4 inches in diameter. The stroke is 30 inches. The view is taken from the high pressure side of the compressor. When operating at 85 r.p.m. the compressor has a piston displacement of [illegible] cubic feet of free air per minute and is designed for a final working pressure of 100 pounds per square inch. Steam is supplied from an adjacent boiler room. The machine is designed to stand a strain of 190 pounds steam pressure

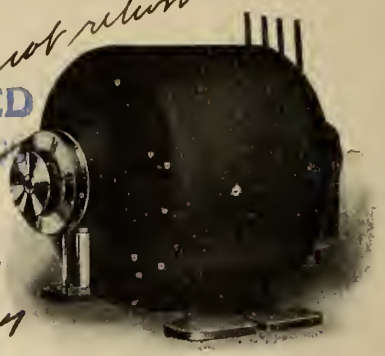


Allis-Chalmers-Bullock Air Compressor in Power House of Canada Car Co., Montreal

with 150 degrees superheat. An idea of the size of the compressor may be gathered from the fly wheel, at the left, which is 12 feet in diameter and weighs 15,000 pounds. The total weight of the compressor is approximately 115,000 pounds.

SMALL POWER MOTORS.

IN the household and industrial field are numerous operations requiring small amounts of power which have usually been laboriously performed by hand, owing to the lack of some convenient and inexpensive driving mechanism. With the growth of the electrical industry and its extension into new lines of work, more attention has been given to the development and perfection of small motors.



Power Motor—Pulley End.

In placing on the market a line of motors which are compact, beautiful and durable the Westinghouse Company feels assured that the results obtained from their use will be most gratifying. For such service as operating sewing machines, dental apparatus, coffee grinders, small ice cream freezers, phonographs, sign flashers, moving window novelties, and hundreds of other adaptations, the smaller sizes may be attached to an ordinary incandescent lamp socket, furnishing a profitable day load for lighting companies.

These motors follow very closely the design of the fan motors described in previous pages—they are built for both alternating and direct-current circuits,

Power Motor—Commutator End

either 115 or 230 volts. The direct-current motors are either shunt or series wound, and the alternating-current motors are wound for 25, 60 or

133 cycles. The efficiency of all machines is exceedingly high.

The base of the motor consists of a separate casting, the frame being drilled and tapped so that the feet may be

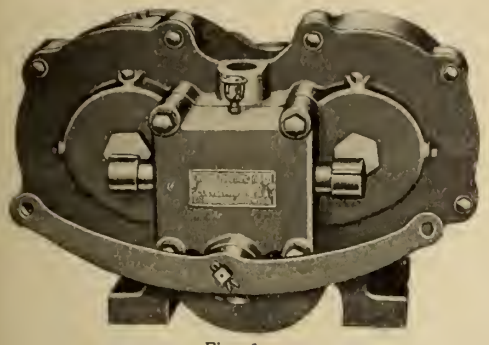


Fig. 1

fastened in any one of four different positions. This construction adapts the motor for mounting in any position. The screw holes in the base are slotted to allow belt adjustment. A two step grooved pulley, suitable for a cord or round belt, is supplied with each motor. The speed abtained by driving from the larger step is about twice that of the smaller.

The bearings are self-oiling and similar in construction to those of the fan motors. They are provided with vertical oil cups with a wick which effectually lubricates the shaft, and a suitable return channel prevents the dripping of oil from the bearings. The leads are brought out through hard rubber bushings, and connection to the motor is easily made. An ordinary lamp cord and plug may be attached to the motor leads for connecting it to an incandescent socket or receptacle. All motors are neatly finished in black enamel with the trimmings of brass, allowing them to be installed where neat appearance is essential. The alternating-current motors are of the single phase induction type with open end frames and split phase winding, the starting coil of which is automatically cut out as the motor comes up to speed. A self-

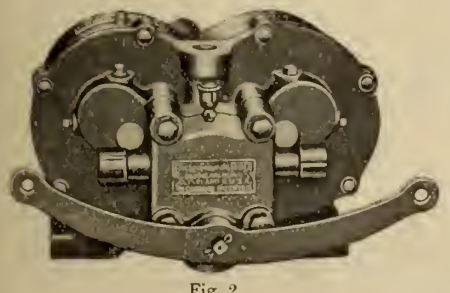


Fig. 2

acting friction clutch engages the load after partial speed has been attained. The direct-current motors are enclosed and are supplied either series or shunt wound, and are so constructed that no starting device is necessary.

THE PNEUMATIC MOTOR.

ILLUSTRATIONS of a pneumatic motor manufactured by the Chicago Pneumatic Tool Co., are given herewith. The pneumatic motor consists of two double oscillating cylinders, set at right angles in an air-tight case. There is no movable valve mechanism, as the oscillation of the cylinders opens and closes the ports. A small quantity of oil is kept in the case, so that the crank in revolving lubricates itself and dashes the oil on the valve seats, from which the air carries it through the inlet ports in sufficient quantities to thoroughly lubricate the pistons. The air ports are controlled by a balanced slide valve, which closes them when on a centre and starts or reverses the motor as it may be turned to the right or left. The valve is thrown by a lever to which chains are attached of proper length to be within easy reach from the floor. When the lever is released the valve is self-closing. The air supply is controlled and the speed of the motor regulated at the will of the operator. The

not returned
RETURNED
APR 25 1906

Westinghouse Small Power Motors

cylinders are bored true, and are automatically adjustable to their valve seats, the adjustment being simple and made from the outside of the motor case. The piston rods are ground. The stuffing boxes are ample and contain sufficient packing for long wear. The cylinder trunnion bearings are bronze. The crank shaft bearings and the crank connections are bronze bushed. The material used throughout is the best obtainable. Superior workmanship is required on all the vital details of construction. Starting Torque of motor is one-half the rated horsepower.

TRACKLESS TROLLEY SYSTEM.

AT Eberswalde in 1901 there was an experimental trackless trolley system installed by a Berlin engineer, but after having been in operation a little over five months it was withdrawn. The length of the Eberswalde line was one kilometer (3,280 feet), running from the railroad station to the centre of the town. For about one-half the distance the road is level and the other half an almost uniform grade of 3 per cent. The roadbed is partly paved with stone blocks and partly macadamized. The electric power, a continuous current from 500 to 550 volts tension, was transmitted on a double line of parallel

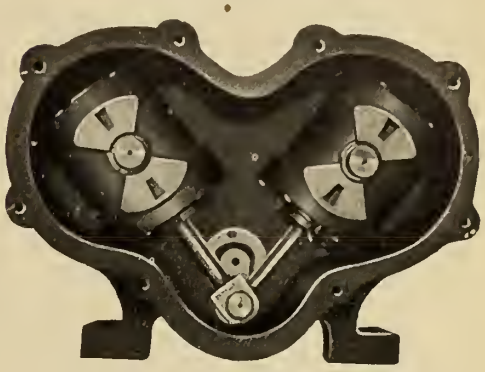


Fig. 3

copper wires 0.315 inch in diameter, 11.8 inches apart, upon which the traveling trolley ran. The latter was equipped with a three-phase motor, which was so adjusted that the trolley always kept at a short distance ahead of the car. The current was received by the wheels of the overhead trolley and transmitted by a flexible cable inclosing six isolated wires—three for the three-phased motor of the trolley, two for the motors of the car, and one for operating an electro-magnetic brake to check the trol-

Fig. 4

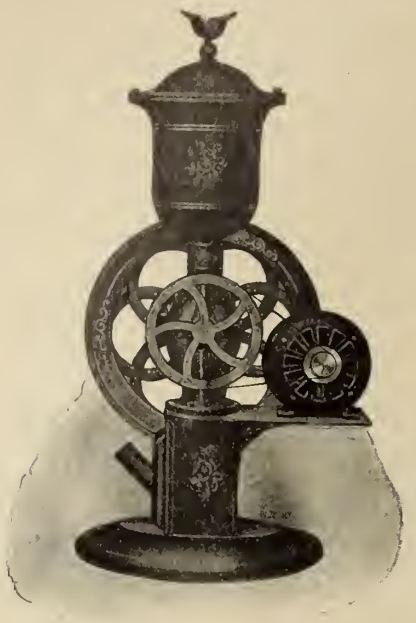
ley in case of necessity, as, for instance, when the car stopped on a grade. The average consumption of current at the central station was 660 watt-hours per kilometer (3,280 feet) per omnibus. The

weight of the omnibus was 3,400 kilograms (7,496 pounds); consumption per ton (2,204.6 pounds) per kilometer, 153 watt-hours; and maximum speed per hour, 14 kilometers (8.7 miles).

Method of Propulsion.

The flexible cable by which the current is transmitted to the motors was connected to an upright or perch on the top of the car by means of a movable sleeve. The tension of the cable was secured by the forward motion of the trolley, but in order to obtain greater elasticity, there was a loop of 4 meters (13.1 feet) put in the cable, which was elongated or shortened by means of a spring and counterweight, the latter working up and down the perch on top of the car. Direction was given to the car by means of a handwheel steering apparatus, acting on the two front wheels of the car, which were pivoted.

An electric motor of eight horsepower was attached to each of the rear wheels. The two motors, however, were capable of producing 25 horsepower for a short time, which was all the power necessary to start the omnibus. Power transmission was by means of chains and cogs. Each car was equipped with change-of-speed and reversing levers.



Power Motor in Operation

The tires used were made of steel. The omnibus was constructed to carry 18 passengers seated, although, if the municipal regulations would permit crowding, there was enough space for double that number.

Cost of Trackless System.

The costs of the installation of the Eberswalde line, owing to unusual conditions, were exceptionally high and can not be regarded as a criterion. The estimated cost of an automobile trolley line of 3.1 miles in length under ordinary circumstances is as follows: Electric line, $9,650; two cars, $6,948; car depot, $2,702; total, $19,300.

The estimated annual cost of operating the above mentioned line on the basis of 30,000 car kilometers annually, the cost of current furnished by the central station being 4.82 1-2 cents per kilowatt, is $1,737. Counting upon receipts of $3,088, or $617.60 per kilometer, the net profit will be $1,351, or 7 per cent. of the capital invested.

The rate charged was 2.38 cents per person. As previously mentioned, the road at Eberswalde was in operation for a little over five months, when, owing to the unusual costs of construction and of operating and keeping the line in

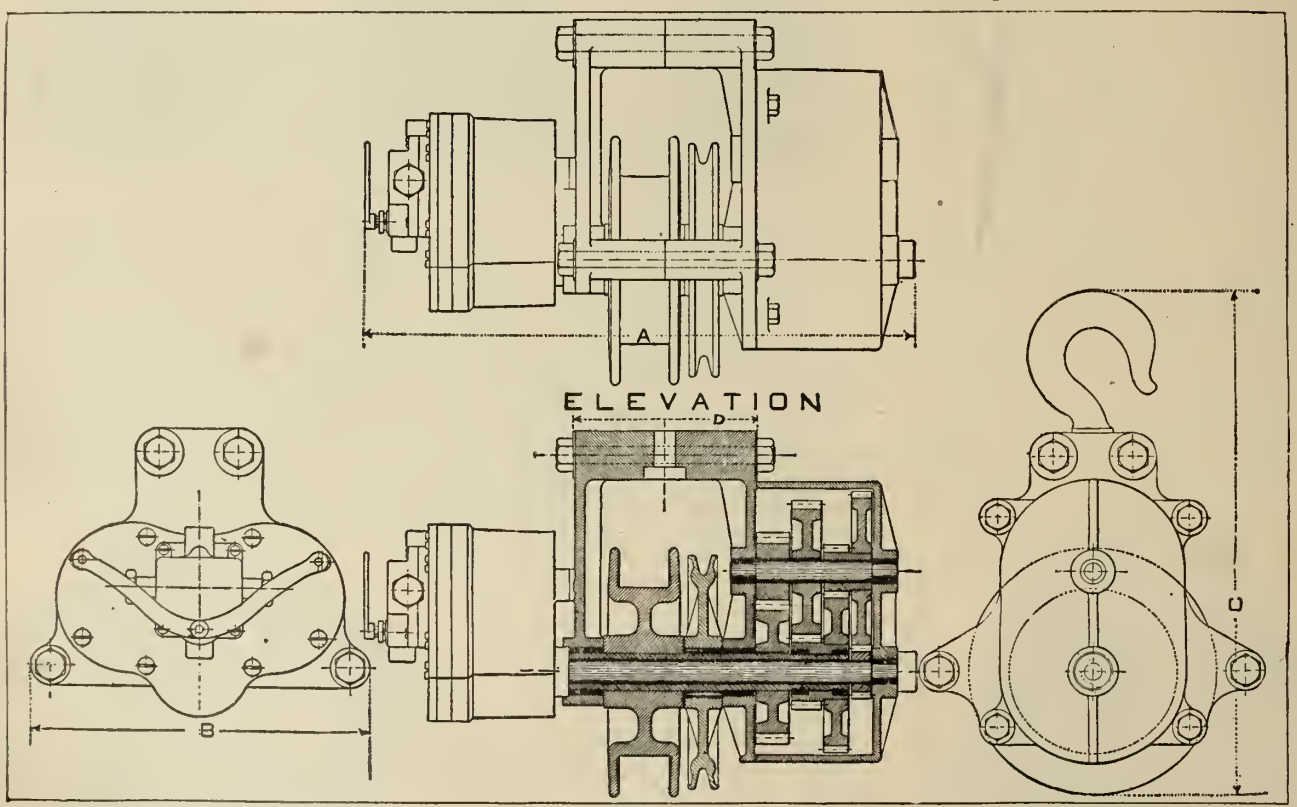


Fig. 218

Size No.	Capacity, Tons	Shortest distance between hooks ins.	Diameter of Drum, inches	No. of Sheaves	Ratio of Gearing	Length of Rope in Wraps						Size of Motor	A	B	C	D
						First		Second		Third						
						Ft.	In.	Ft.	In.	Ft.	In.					
10	1	33	6½	0	39 to 1	20	10	23	2	25	4	1	24	14	20	7⅛
11	1½	37	6½	1	39 to 1	20	10	23	2	25	4	1	24	14	20	7⅛
12	3	42½	8 1/16	1	54 to 1	13	5	14	11	16	5	2	27	16½	25	7¾
13	5	56	9 3/16	2	33 to 1	18	0	19	10	21	7	5	33½	21	31½	11
14	10	58½	9 3/16	4	57 to 1	18	0	19	10	21	7	5	37	21	35¼	11

General Outline Drawing of Pneumatic Geared Hoist.

repair, it was withdrawn by the company, although, as the mayor of the town informed me, the line worked to the satisfaction of the municipal authorities. There were some interruptions in the running of the cars, but these were due to the faulty installation of the temporary central power station and not to faults of the system itself. There was also some difficulty experienced with the automatic windlass for keeping a tension on the flexible conductor, causing the trolley to fly off at times.

In conversation with an American engineer, a traction expert and one who is familiar with the conditions existing in cities like Detroit, he expressed the opinion that a petroleum or gasoline motor omnibus would give the most economical results.

Photographs of the car, motors, etc., used at Ebeswalde were furnished by Consul-General Thackara and will be loaned to parties interested upon application to the Bureau of Manufactures.

PRIZES FOR CEMENT DATA.

PRIZES amounting to about $750 are being offered by the Prussian Government and the German Society of Portland Cement Manufacturers, for essays on the processes which take place in the hardening of hydraulic cements. The essays, which take as general subject matter the demonstration of properties and of the induration processes of calcareous hydraulic cements, synthetically, analytically, microscopically and mineralogically as applied to hardening in air, fresh and sea water, may deal with all or any of the following questions:

1. To prove whether silicic acid, alumina and oxide of iron with lime as crystalloids in stable proportions or as colloids in varying proportions.

2. To prove whether double combinations result between silicic acid, alumina and oxide of iron with lime, and in what manner these substances take part in the hardening process.

3. Consideration of the swelling phenomena which accompanies the hydraulic hardening.

4. Consideration of the influence of the temperature and the duration of the burning process on the different kinds of hydraulic cements.

5. Properties of puzzolana and its hardening with lime; beginning with silicic acid, as the most active and prominent puzzolana, alumina, oxide of iron and manganese, independently and in combination with silicic acid, either as natural or artificial puzzolanna. The papers must be written in German and must be submitted under a nom de guerre to the Minister of Public Works, 80 Wilhelmstrasse, Berlin, on or before December 31, 1906.

BOOK REVIEWS

Link Motion. By Fred H. Colvin, sent with the compliments of H. B. Underwood & Co., Philadelphia, New York, the Derry-Collard Co., first edition, 90 pages, illustrated.

This valuable little book deals with link motions, valves and valve settings in a very complete manner, being a subject upon which the author is particularly fitted to express not only an authoritative opinion, but give the benefit of a deep insight into the best practice. The line drawings are clear and easily understood. While the various curved diagrams embody valuable data on the subject.

Injectors: Their Theory, Construction and Working, by W. W. Fullen. Third edition. Manchester: The Technical Publishing Co., Limited, and New York: D. Van Nostrand Co.

This is the third edition of the author's treatise. Since the second edition appeared much experimental work has been done on the steam jet, consequently it has been found necessary to rewrite a good half of the first book, much new matter having been added and many illustrations. In addition to the theory and action of the injector the author goes into detail regarding the mechanism and principles of operation of the various injectors on the market throughout the world. Besides giving the technical side of the question full attention, the author gives considerable space to history and general description. It is of more than passing interest to all those connected with the use of steam boilers.

Notes on Heating and Ventilating, by John R. Allan, Prof. Mechanical Engineering, University of Michigan, Chicago. Published by Domestic Engineering.

In this book various chapters are arranged from a resume of a series of lectures delivered by the author to the classes on heating and ventilating at the University of Michigan and published in a number of articles in Domestic Engineering. One of the main features brought out is the fact of the exact science to which the systems of heating and ventilating have been reduced. The author commences with the theory of heat and measurement of temperature and takes up the different forms of heating systems, their advantages, disadvantages and relative economy. Central heating systems are also given some attention as well as the apparatus required for heating and ventilating. The book is simple and of considerable value to all interested in this line.

Cams, and the Principles of their Construction, by Geo. Jepson, Instructor of Mechnical Drawing, Massachusetts Art School. Cloth bound, 53 pages, illustrated price, $1.50 net. New York: D. Van Nostrand.

On taking up this book, the reader is rather surprised to find the author launching into his subject seemingly in the middle of his work, but a note elsewhere points out that this treatise on cams is to be included in a book on mechanical drawing of which the subject of cams will form a part. The importance of the cam in machinery of various kinds is shown and the method of its adoption to various uses brought out. The author illustrates each step with splendid diagrams and shows exactly how various shapes and mechanisms are drawn out. To the mechanic as well as to the student of mechanical drawing and the mechanical engineer, this book will appeal as giving a practical working knowledge of the subject.

Electric Power Plants, by Norman H. Schneider, electrical engineer. Second edition, cloth bound, 274 pages. New York: Spon & Chamberlain, 123 Liberty street.

In presenting this second edition to the readers the author intimates that it is intended as a hand-book of practical information for those who are called upon to operate a commercial or military electric plant without having had much previous experience, as well as giving valuable information to the engineer. As it was written from notes taken while the author himself was actually handling the apparatus described, it should be practical and to the point. The author leads the reader into the company of the different electrical machinery and apparatus and the conditions met there describing different forms of generators and motors and their care and management, as well as their test and measurement. Besides these some practical notes are given on batteries and belting. While the drawings in this book are clear the engravings are of poor quality.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

SPECIAL PORTABLE MILLING MACHINE.

H. B. UNDERWOOD & Co., of Philadelphia, have just placed on the market a machine that is a departure from anything yet brought out in the shape of a portable milling machine. This machine is the outgrowth of a temporary rig that we were forced to make to do work on a large machine in a stated time and in place, and from that idea has been elaborated on from time to time until it has become one of our special tools. It is designated for straight line work, 8 feet long, with a number of surfaces in line but on different planes. It being motor driven allows it to be taken to the work, and work of such a character that no machine tool built do as required, for the work can be done after all parts are assembled. The carriage has a travel of 8 feet, with automatic feed; the cross slide has a travel of 12 inches; the vertical spindle a travel up and down of 10 inches. The spindle has a taper hole to receive taper shank mills; the slide on the machine has hand feed. The bed is mounted on a sub base, allowing accurate adjustment by set screws setting up against taper spaces, pieces securely holding the two beds as solid as though in one piece. This sub base has long slots and projections for securing to the work by clamps or bolts.

Underwood Portable Miller

NEW CRESCENT ANGLE BAND SAW

THE cuts of the band saw shown on this page shows a new machine that is a decided innovation from the common type of machines. The machine is designed to overcome the difficulties and inconveniences incident to the tilting-table machines, and on this machine the table is always level whether doing square or angle sawing, regardless of the angle being cut. This is accomplished by tilting the arm upon which the upper wheel is mounted to the desired angle. This arm is hinged into the pedestal in a very rigid manner, making the machine as rigid and durable as any of the common type of machines. The method employed in hinging the arm is very similar to the method of mounting the table of a common drill press to its column and in comparison is as rigid. The only operation necessary to change angle of cut is to turn hand wheel at side of table until index under table points to desired angle on the graduated quadrant. The guides keep proper alignment with saw without attention. There are no sliding throat-blocks to push into position, as the table travels automatically to keep saw in proper register in the saw slot. The one operation of turning the hand wheel takes care of all the adjustable parts of the tilting mechanism, and if desired the machine may be tilted while the saw is cutting. This feature adapts the machine for boat work or other similar work. The arm is suitably counterbalanced so hand wheel turns easily. Extreme simplicity is also claimed for the machine, there being but a few more parts used than on the common type of band saw made by the same manufacturers. The novel features of the machine are covered by patents recently issued.

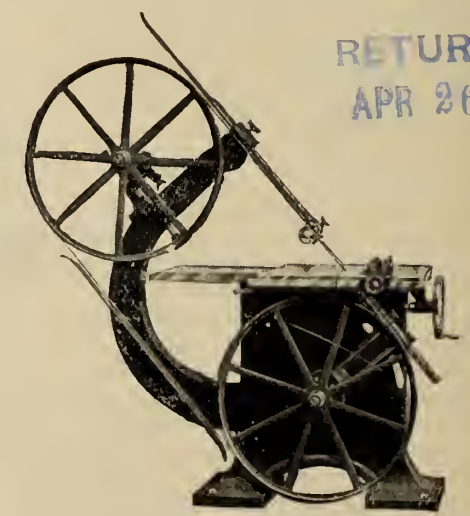
The machine has already had an extensive sale, and the manufacturers report that they have plans under way for enlarging their factory to accommodate their increasing business. A postal card addressed to the Crescent Machine Co., Leetonia, Ohio, will bring a copy of their new catalogue in which the machine is more fully described.

RETURNED
APR 26 1906

Fig. 1—The Crescent Angle Band Saw Erect for Square Sawing

CHAIN MAKING BY MACHINERY

ONE of the last industries to be invaded by the all-conquering machine is that of chain making. The manufacture of chains, which in England has had its seat in Cradley Heath and the neighboring villages for certainly over a cen-



RETURNED
APR 26 1906

Fig. 2—The Crescent Angle Band Saw Tilted for Bevel Sawing

tury, has held out for long against the falling into line of modern economy and the supersession of the old hand process by labor-saving machinery.

The old process of chain making was the anvil one, indeed still is, because, although chain making machinery is being introduced, conservatism dies hard, and the methods of our grandfathers are far from extinct. Under this old process the iron was cut into short lengths, each sufficient to make one link. After being heated in the furnace once, the bar was bent into a U-shape; after a second heating the two ends were tapered down, and after a third heating the link was welded on the horn of the anvil, the whole operation being performed with a hand hammer. An expert chain smith at such work might turn out, perhaps, 40 ft. of ¾ in. coil chain per day, but could scarcely do more.

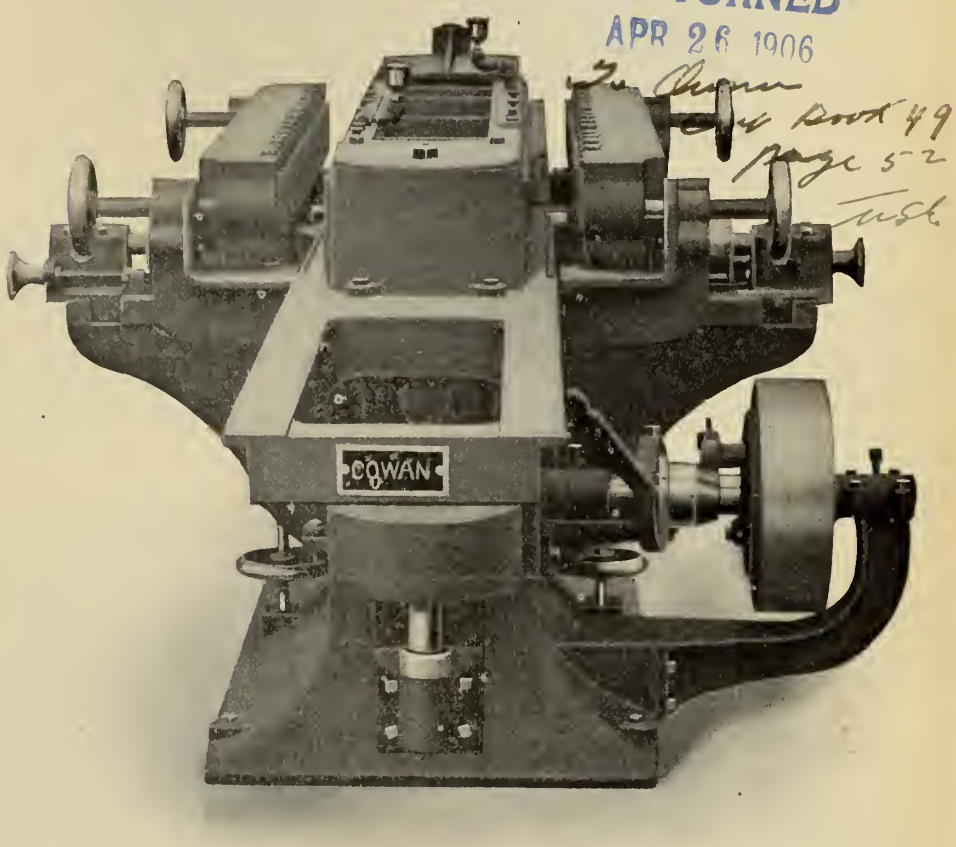
Under the new machinery output has been multiplied by four, and the quality is not inferior. One heavy machine—called the link-winding machine—coils the round iron bar of any thickness within the compass of the machine's power around a mandril without heating. The mere fact of the iron being wound cold ensures a certain standard of quality, as poor iron would not stand the process. The result of the coil-winding is that the bar issues in the form of a close spiral spring, the circle of each coil containing a sufficient length of iron for one link. The size of the mandril used is, of course, suited to the chain which is in process of manufacture. The next process is that these coiled bars are subjected to the link-cutting machine, which also operates upon the iron in a cold state. Each coil is cut off at an angle of 60 deg. from the face of the flat section, this form being best suited for the subsequent welding. The welding machine is the last, and not the least, ingenious of the three called into requisition in the modern process of chain making. It is really a spring hammer driven by power, and controlled by a foot lever. When the foot lever is not depressed, the hammer is raised clear from the anvil or bed. Thus there is always space to allow the chain to be placed in position or withdrawn. The depression of the controlling foot lever brings the hammer into action, and blow succeeds blow, until the operator, believing the welding to be satisfactory, releases the lever, and the hammer rests ready to descend for the next link. This operation is, of course, performed with the half-formed links heated to a welding heat. The hammer and the anvil are fitted with steel dies or molds suited to the shape of the link being manufactured. These dies are easily removable, so that different sizes of chain may be made on the same welding machine. Before putting the link to be formed under the hammer it is hooked into the link last formed, and thus the chain is built up.

CONTINUOUS FEED GLUE JOINTER

A MACHINE that can be used on long or short stock with equal success and will make a clean cut joint, is a recent product of the works of Cowan & Co., Galt.

The frame is cast in one piece and is of rigid design, thereby avoiding twisting and straining when doing rapid work. The chain is composed of forty-four links all milled accurately to fit

RETURNED
APR 26 1906
Book 49
page 5-2



Cowan Continuous Feed Glue Jointer.

cams so as to ensure a smooth running motion, and corrugated to ensure stock passing through without slipping. The pressure bars are each provided with twelve 2 inch by 2 inch knurled steel rollers which operate upon tempered springs. Variations of 1-4 inch or 3-8 inch in stock does not make it necessary to change bars, as springs take care of this. Bars are adjusted by hand wheels on either end of bar, and adjustments can be made in an instant. The arbors are made of special high carbon steel of large diameter, and run in self-oiling bearings. They have vertical and lateral adjustment. They are fitted with any kind of solid cutters desired for either tongue or groove or straight-faced joints. The feed is controlled by friction pulley which drives the gears and can be started or stopped instantly by throwing lever. It is geared six to one, and has three rates of feed, 45, 57 and 68 lineal feet per minute, about four times the capacity of ordinary machines. Will take stock from 6 inches up to any length and from the thinnest to 2 1-4 inches thick. The gears are made of steel and after the most approved methods, ensuring long life and a smooth running machine. Countershafts are provided and machine can be belted from below as well as from above. Fast and loose pulleys 12 in. diameter, 6 in. face, and should make 900 revolutions per minute. Drive pulley 22 in. diameter, 4 in. face; arbor pulley 4 in. diameter, 4 1-2 in. face, and should make 5,000 revolutions per minute. Floor space required 13 feet 6 in. by 3 feet 8 in. for 6 foot machine.

VICTOR PIPE MACHINE.

RATHER antagonistic qualities, strength and lightness are desirable in a pipe threading machine. The pipe machine illustrated as manufactured by the Loew Manufacturing Co., Cleveland, Ohio, embodies these two features. It is solidly constructed.

being designed to resist rough usage and as may be seen from the engraving, occupies a comparatively small space. Power is transmitted by a double-lead worm gear, set close to the base of the machine, the worm gear having been found to be more powerful than bevel gears, and by using a double-lead worm gear the speed maintained is the same as if bevel gears were used.

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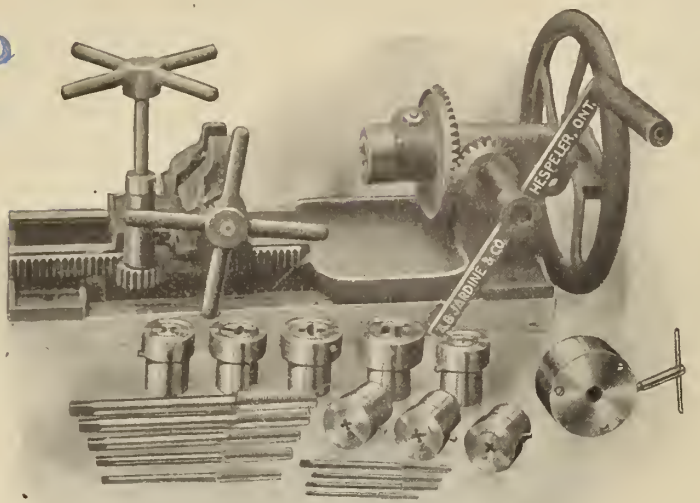

Jardine Bolt Machine—Hand Drive

Another important feature in connection with the dies is that during the operation of cutting the thread the pressure of the pipe against them prevents all danger of their slipping. Usually it is necessay to employ some device to lock the head, to prevent the die from slipping after the threading begins. No levers or locking devices used on the head, and there are no projections on the face plate. The face plate adjusts the dies, which engage in a continuous scroll on the back of the plate. The plate is self-locking, requiring no bolts to lock the dies when adjusted to the desired size. Each machine is supplied with an oil can and a tripod for supporting.

The vise is a universal, self-centreing vise, with two long bearing jaws made of tool steel. The pipe is clamped in the vise by a hand wheel which is large enough to insure the pipe being held perfectly rigid in the jaws when set. To assist in setting the dies there are gradnations on the face plate. The dies are set by inserting a small hand bar on the edge of the face plate, shifting it backward and forward as necessary. When the pipe is placed in the machine and the size has been adjusted and the vise jaws clamped, the operation is started by drawing the hand lever toward the front of the machine and revolving the the head by means of the hand crank. After the pipe is started into the dies it continues to feed itself automatically. After the thread has been cut the dies are released by inserting the bar into one of the holes in the edge of the face plate and opening it slowly. This takes off the burrs of the thread. The quick opening feature obviates the necessity of reversing the machine and backing the pipe out of the dies.

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The Die Side of the Victor Pipe Machine.

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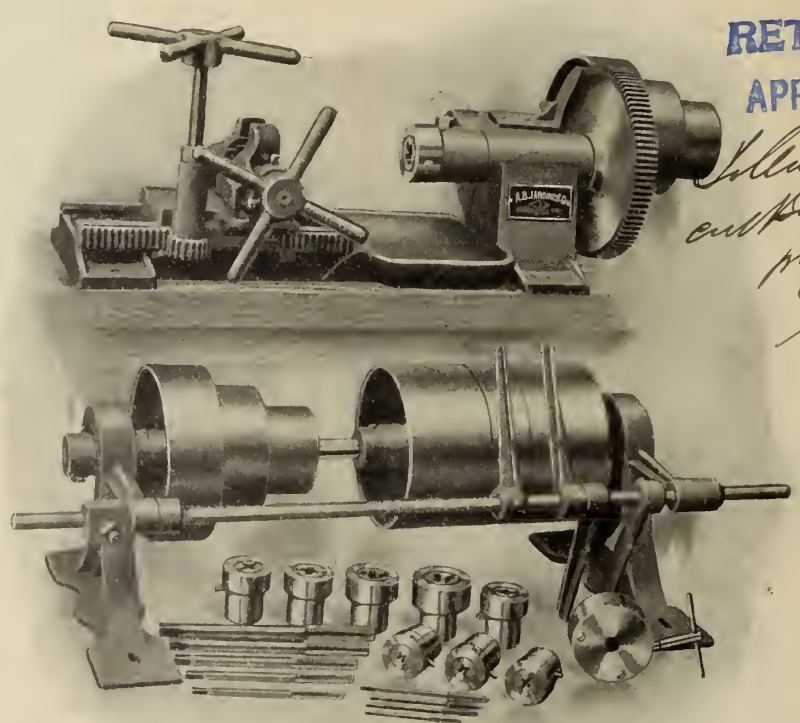

Jardine Bolt Machine—Power Drive

SHORT HISTORY OF AN IMPORTANT TOOL.

WHEN the last century came in the steel square used by every carpenter had never been made. The inventor of this square was Silas Howes, who lived in South Shaftsbury, Vt. One day, according to Modern Machinery, Silas was visited by a peddler who called to have a shoe set on his horses. These peddlers were given to excessive barter and exchange. This one had some worn-out steel saws and then and there Silas received the inspiration to make a square. He shoed the horse and was paid in old

saws. Silas proposed to weld and polish the saws and make a rule superior to anything in use. He succeeded and marked it off into fractions of inches and found it good for the purpose. At first he made them at odd times and sent them out by the peddler, who found every handy man and carpenter eager to possess one at $5 and $6. The orders exceeded the supply and Silas applied for and obtained a patent for the invention. Gradually he worked up enough business to build a factory, which was the beginning of a large industry. Silas Howes became a very rich man and was a generous one. Squares are now being made on the site where the first one was manufactured ninety-five years ago.

125 TONS OF METAL IN A SINGLE CASTING.

PATTERNS for what will be the heaviest single casting ever poured at the works of the Allis-Chalmers Co., Milwaukee, were completed recently in the pattern shops of the West Allis works. The casting in question is designed for the frame and slide of a large horizontal rolling mill engine being built for the Carnegie Steel Co., Sharon, Pa., whose cylinders will be 50 and 78 inches diameter with a 60-inch stroke. The pattern for this piece, measuring 2 feet long, 11 feet wide and 10 feet high, represents the work of ten expert pattern makers for a period of four months. The amount of lumber of various sizes used in its making aggregated 22,000 feet. The pattern was taken from the pattern shop directly to the foundry where work has begun on the construction of the mold. The pit in which the piece will be poured is 40 feet long, 15 feet wide and 11 feet deep. The mold, when completed and ready to receive the molten metal, will take approximately 133 tons of iron; the actual operation of pouring will consume some eight to ten minutes. Nine ladles will be used to convey the liquid metal to the mold, four of which will each be of five tons capacity, four of 25 tons and one of 13 tons. After the metal is poured, the casting will be allowed to stand and cool for six days before the mold will be broken.

Two of the largest traveling cranes will be required to lift the casting, the aggregate weight of which will approximate 125 tons. It is expected that the finished piece will be ready for shipment in from seven to eight months' time, when one of the new sixteen wheel 100-ton flat cars, now being built for the Allis-Chalmers Co. at the West Milwaukee shops of the Chicago, Milwaukee & St. Paul railway, will convey the piece to Sharon, its final destination.

At the Noon Hour

Ought to be Satisfactory.

"I suppose," said the fair customer, "you guarantee these corsets?"

"Certainly, madam," replied the absent-minded clerk, who had formerly traveled for a boiler foundry. "We warrant them to stand a pressure of 700 pounds."

* * *

The Overworked Boiler.

"Are you chief engineer of this concern?" asked an excited individual of the sub-editor.

"No, sir, I'm not the engineer; I'm the boiler," and he proceeded to "boil down" six sheets of matter into a note of six lines.—Tit-Bits.

* * *

Father Knew.

"Pop."

"What is it, Johnny?"

"Why is the head of a bedstead always higher than the foot?"

"For the same reason that the rear wheels of a wagon are always bigger than the front ones, Johnny."

"Thanks, pop."—Kansas City Times.

* * *

No Work for Him.

Housekeeper: "You're a big, healthy man; why don't you go to work?"

Tramp: "Lady, I'll tell yer me trouble. I'm an 'unhappy medium.'"

"What do you mean by that?"

"Well, yer see, I'm too heavy for light work, an' too light for heavy work."—Pearson's Weekly.

* * *

She Swore Off.

An old lady who was in the habit of saying after any event that she had foretold it was one day "sold" by her husband, who had got tired of her eternal "I told you so!"

Rushing into the house, he dropped into a chair, raised his hands, and exclaimed: "Oh, my dear, what do you think? The old cow has gone and eaten the grindstone!"

"I told you so! I told you so!" was the reply. "You always let is stand out of doors."

* * *

The Attainment of an Ideal.

We have all of us an ideal—all of us,, that is to say, who are likely to be worth anything, and the only difficulty about the matter is that not one per cent. of us ever attain it.

The reason is not far to seek, for the inability to reach the limit of our desires is caused by our failing to grasp the utmost possibilities of our present position. It is no good for a clerk on thirty shillings a week to wish to become a millionaire unless he can extract all the possible good out of his present limited income.

The very meanest position, the very humblest office has its own ideals, and unless the man in the mean position has found the fullest capabilities of his lot, he will never get much higher on the ladder of success.

To put this more plainly, there are many ways of living through every walk of life, and it is your duty, if you would get on, to find out the best way of living your own particular life.

If you are an apprentice at present, the moment you have realized the full possibilities of your apprenticeship you are ready in every way to go in for something better. If, on the other hand, you have not made yourself acquainted with those possibilities, there is not the least use in the world for you to sigh for things you will never be able to possess. Plant your foot firmly on the rung of life's ladder upon which you now stand, and it will not be long before you will find you are standing on the next one.

* * *

A Pie Machine.

One man and three boys, with the aid of a machine, can make 16 pies a minute. The machine is 10 feet long and 20 feet wide. An electric motor furnishes power and a gas jet keeps the dies warm. Observing the working process of the machine does not dispel the Yankee appetite for pie, but a description of it beginning with the tank suspended over the machine holding "filling" for 400 pies with a revolving agitator to keep the stuff from blocking the outlet would tend to reduce the search at lunch counters for "pies that mother used to make."—Ex.

* * *

In Olden Times.

"There goes Rome's celebrated lightning calculator," says Quintus Flaccus to Casca Smith, who is spending a few days in the capital city.

"Who do you mean—that high-browed man going down the Appian way?"

"Yes. That is Numerous Speedibus. It was day before yesterday that he gave a public exhibition, and one of his amazing feats was the multiplication of MDCCCLXXXVIII by MMCCCXXXIXX in forty-two minutes by the elepsidra."—Ex.

ABOUT CATALOGUES

By mentioning Canadian Machinery to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

Sur-Coat. A catalogue of the Sur-Coat Mfg. Co., Windsor, Ont., describing the merit of sur-coat for removing scale from boilers. It contains many testimonial letters. Size, 5 1-2 x 6.

Grooved Shank Chucks. A folder issued by Baines & Peckover, Bay street, Toronto, of the grain grooved shank chuck for drills, reamers, taps, etc., and describing the grooved system. 3 1-2 x 6 1-4.

Equipment of Modern Ship Yard. A 16-page bulletin, splendidly illustrated, describing the electric equipment of a modern shipyard, showing the adaptation of the Bullock motor to various machine tools. Size, 8 x 10 1-2.

Clutchology. Describes the automatic clutch manufactured by the Automatic Clutch Co., Akron, Ohio, the motto being "The greater the load the tighter the grip," and self-adjusting. 16 pages, 3 1-2 x 6 1-4.

The Interpole Motor. Circular No. 25, issued by the Electro Dynamic Co., Bayonne, N.J., gives a short description of the interpole motor and a number of illustrations showing the wide range of application. Size, 6 x 9.

Electric Motors and Dynamos. Bulletin D issued by the Maple Leaf Automobile Electric & Mfg. Co., London, Canada, shows the different lines manufactured by this company, together with some testimonials telling of their success.

The Rise of a Great Company. An 8-page folder issued by the Allis-Chalmers Co., shows the progress made by that company in recent years. Illustrations of the various plants are given and a general survey of the lines turned out.

Gas Producing Apparatus. C. M. Kemp Mfg. Co., Baltimore, Md., are sending out their catalogue of the Twentieth Century gas producing apparatus supplied by them. The process for producing gas is described and illustrated. 22 pages, 6 x 9.

Marine Motors. Buffalo motors manufactured by the Buffalo Gasoline Motor Co., of Buffalo, N.Y., are fully described in this catalogue, which contains many illustrations of the different lines. These are all used for marine purposes. 32 pages, 6 x 9.

The Defiance. An 8-page folder issued by the Defiance Iron Works Co., Limited, Chatham, Ont., describing their marine stationary and portable gas and gasoline engines and launches as manufactured by them and being placed on the Canadian market with considerable success.

Blue Book of Rope Transmission. The 4th dition of the catalogue published by the American Mfg. Co., 65 Wall street, New York. It shows the advantages of rope drives and their adaptability to different commercial problems. It is well printed and handsomely illustrated. 58 pages, 6 x 8.

Westinghouse Fan Motors. A beautiful catalogue issued from the publishing department of the Westinghouse Electric & Mfg. Co., Pittsburg. The fans being placed on the market by them for 1906 are therein illustrated. In addition a number of pages are devoted to small power motors for both direct and alternating current. Nineteen pages, 6 x 9.

Power Gas Plants. A reprint from the Practical Engineer of a paper by Thos. Rigby, on power gas plants and some of their uses. It goes into the subject in a thorough manner from a technical and practical standpoint. Reports of some actual tests are given that show the operation of these gas plants. 63 pages, 5 x 7 1-4.

Hoisting Machinery. A descriptive catalogue of the Harris patent power hoisting and carrying machine, manufactured by C. S. Harris Co., Rome, N.Y. It describes the machine and its special features as well as giving instructions for installing, together with a number of illustrations showing its adaptation. 24 pages, 6 x 9.

Turbines and Centrifugal Pumps. Catalogue just issued by I. P. Morris Co., Philadelphia, the mechanical engineering Co., of the Wm. Cramp & Sons' Ship and Engine Building. It illustrates the enormous turbine built by this company. Shawinigin Water & Power Co. shows curves of tests on this and other large units. 10 pages, 8 1-2 x 10 1-2.

Crossley's Gas Engine. The English makers of gas engines have begun to notice the normous field for their output in Canada. The catalogue in question describes the admirable points of the Crossley Bros., Limited, gas and oil engine manufactured at Openshaw, Manchester. These engines are substantially built and of attractive design. Size, 5 1-2 x 8 3-4.

Loomis-Pettibone Gas Generating Plants are attractively described by means of diagrams and colored plates in a new pamphlet that is being issued by the Power & Mining Machinery Co., Milwaukee, Wisconsin. This system gasifies bituminous coal, wood, charcoal, lignite, etc., and produces a gas that is particularly adapted to the operation of gas engines. The water gas made by this system can be used separately in various feeding work, such as forging, welding, tempering, etc. This pamphlet can be had upon application to the company.

Machinery and Tools. The 1906 catalogue of Brown & Sharpe Mfg. Co., Providence, R.I., has recently been issued. Any who have in previous years received this catalogue know its completeness and value, containing as it does not only illustrations and descriptions of the various lines manufactured by Brown & Sharpe, but, as well, many pages of valuable data and tables for the machinists and manufacturer. Anyone desiring one of these catalogues will receive same by dropping a post card to Brown & Sharpe, mentioning this paper.

Horizontal Engines. Bulletin No. 137 has just been issued by the B. F. Sturtevant Co., of Boston, Mass., in its engineering series. It very fully illustrates this series of engines, ranging from 20 to 200 H.P. capacity, which has recently been entirely redesigned. All engines are now completely enclosed, provided with watersheded partitions and equipped with forced librication. Although primarily designed for direct connected driving of Sturtevant generators, these engines are peculiarly adapted for all classes of work where high speed, efficiency and perfect regulation are desired. The positive system of forced lubrication relieves the engineer of anxiety and insures continuous operation with the minimum of care.

SOMETHING OR NOTHING

Every man who can be a first-rare something—as every man can be who is a man at all—has no right to be a fifth-rate something; for a fifth-rate something is no better than a first-rate nothing.—J. G. Holland.

* * *

Every great reform which has been effected has consisted, not in doing something new, but in undoing something old—Buckle.

ENGINEERING NEWS

AND SOCIETY NOTES

SOCIETY OFFICERS.

Canadian Mining Institute.

President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer Lamb, Victoria, B.C.; treasurer, J. Stevenson Brown, Montreal.

Toronto Branch A. I. E. E.

Chairman, H. A. Moore; vice-chairman, R. G. Black; secretary, R. T. McKeen.

Marine Engineers.

Grand president, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N.B.

Canadian Electrical Association.

President, A. A. Wright, M.P., Renfrew, Ont; vice-presidents, R. G. Black, Toronto, John Murphy, Ottawa; secretary-treasurer, C. H. Mortimer, Confederation Life Building, Toronto.

Canadian Association of Stationary Engineers.

President, Wm. A. Sweet, Hamilton: vice-president, Jos. Ironsides; secretary, Wm. Outhwaite, Toronto; conductor, Ed. Grandbois, Chatham; doorkeeper, Chas. Kelly, Chatham.

Ontario Association of Stationary Engineers.

President, Geo. Fowler, Toronto; vice-president, W. F. Chapman, Brockville; treasurer, Charles Moseley, Toronto; registrar, W. G. Blackgrove, Toronto.

Canadian Railway Club.

President, S. King; secretary, James Powell, chief draughtsman motive power department, G. T. R. treasurer, S. S. Underwood, chief draughtsman car department, G. T. R.

Engineers' Club of Toronto.

President, F. L. Sommerville; treasurer, W. J. Bowers; secretary, Willis Chipman, Rooms 96 King St. W.

Canadian Society of Civil Engineers.

President, H. D. Lumsden, Ottawa; vice-presidents, M. J. Butler, Ottawa; C. B. Smith, Toronto; W. M. Walbank, Montreal; secretary-treasurer, not yet appointed. Rooms, 877 Dorchester street, Montreal.

Society of Chemical Industry

Chairman, Prof. W. H. Ellis; vice-chairmen, H. H. Van Der Linde, Milton; H. Hersey, A. McGill; hon.-secy., Alfred Burton, 11 York Street, Toronto.

Ontario Land Surveyors.

President, Otto J. Klotz, Ottawa; vice-pres., Thos. Fawcett, Niagara Falls; secy.-treas., Capt. Killaly Gamble, Toronto.

Engineers' Society, S.P.S., Toronto University.

President, K. A. McKenzie; vice-pres., B. J. McGugan, rec. secy., A. M. Damn; treas., G. E. Quance; cor. secy., A. E. Jupp.

Civil Engineers' Meetings.

At meetings of the mechanical and general section of the Canadian Society of Civil Engineers, held at their rooms in Dorchester street, Montreal, papers of considerable interest have been read. Amongst these were "Notes on the Shops and Power House of the Canada Car Co.," by E. G. M. Cape; "Durability of Wire Rope Under Severe Conditions," by P. H. Schwitzer; "Formulae for Reinforced Concrete Beams," by Henry Goldmarch. These papers were all illustrated by lantern slides.

Toronto Engineers' Club.

When the Engineesr' Club of Toronto met at their rooms during the month of April, a wide range of subjects was described and discussed. The first meeting resolved itself into a discussion of the city plan of improvements. At the other meetings the following papers were read and discussed: "The Hillsborough Bridge," by M. J. Haney; "Turbine Pumps," by W. C. Brown, Montreal; "Electric Smelting of Iron Ore," by J. W. Evans.

Society of Chemical Industry

The Canadian section of the Society of Chemical Industry held its annual meeting in the Engineers' Club Room, Toronto, on April 6. The proceedings opened with a dinner at 6 p.m., with the president, Dr. F. J. Smale, in the chair. The following officers were elected for the ensuing year: Chairman, Prof. W. H. Ellis, of Toronto; vice-chairmen, H. Van Der Linde of Toronto, Milton H. Hersey of Toronto, A. McGill of Ottawa; committee, James H. Bowman of London, W. R. Lang, J. P. Murray, Charles Heys, W. H. Van Winckel, W. Lash Miller, Prof. W. P. Cohoe and Dr. F. J. Smale, all of Toronto, Prof. M. A. Parker of Winnipeg, Prof. R. F. Rattan of Montreal, and E. B. Chadsey of Hamilton; honorary local treasurer, J. W. Bain; honorary local secretary, Alfred Burton.

A paper was read by Prof. W. R. Lang, of the University of Toronto, on "The Determination of Boric Acid," the result of joint investigation by the author and Mr. R. J. Manning, of the University of Toronto. The methods devised by these gentlemen gave much more accurate results and, therefore, more valuable in connection with the estimation of the percentage in food stuffs than any methods heretofore in use. Following this was a paper, "A Talk on Foundry Chemistry," by H. L. Bowers, B.S., which was followed by an interesting discussion.

In view of the importance of this society from the fact of its influence in other countries there has not been as much progress made as should be expected. This is probably due to the fact that people have not realized to what an extent all manufacture is indebted to chemistry, the result being that a few enthusiasts are left to work up this field while every manufacturer in the country should be personally interested. The presidents of the parent society in England have been among the most prominent scientists of the country.

Amendments to Stationary Engineers' Act.

At a meeting of the executive of the Canadian Manufacturers' Association a resolution was adopted in favor of the proposed amendment in the act regarding stationary engineers under consideration at the present session. The plea of the engineers is a just one and it is satisfactory to note its favorable consideration at the hands of the Legislature. The following clauses are included:

It shall be unlawful for any person to operate any boiler of 50 horse-power or over unless he has a certificate granted under the provisions of this act;

It shall be unlawful for any person to employ an engineer to take charge of a boiler of 50 horse-power or over unless such person holds a certificate under the provisions of the act, and any person who shall be guilty of operating, or any employer who shall employ any person to operate, a boiler contrary to this act, shall be deemed to have committed a misdemeanor;

Every engineer who shall be in charge of any steam plant coming under the provisions of this act at the time it comes into force or any engineer who has had two years' experience and who applies before the expiry of one year, shall, upon proving his character and upon paying the prescribed fee, receive a certificate for the term of two years, and such certificate must be renewed from time to time as it expires, provided, however, the board shall have power to revoke any certificate upon proof of incapacity, drunkenness, or improper conduct;

Any person who feels himself aggrieved by the decision of the board of examiners shall have the right (upon notice being given to that effect) to appeal to the Minister of Agriculture;

All candidates for certificates, except as provided for in section 4, shall furnish evidence of their good character, and of having at least three years' experience, either as assistants in an engine room, or boiler room, or as having full charge, and shall submit to such examination, written or oral, as the board may determine;

All certificates shall at all times be exposed to view in some conspicuous place in the boiler or engine room, and the failure to expose same will be prima facie evidence of the lack of qualifications under the act.

ELECTRIC POWER FOR ONTARIO.

(Continued from page 177)

tion adopted is that of steel towers and first-class cedar pole construction.

Cost to Municipalities.

For Hamilton and Dundas, with 16,000 h.p. estimated requirements, the cost per h.p. is taken at $15.36 a year; for 8,000 h.p. at $16.30.

Toronto, 50,250 h.p., $16.53; 25,125 h.p., $17.15.

Orangeville, for full load estimated, $23.66; half load, $30.54.

Brampton, $21.23 and $25.37.

Georgetown, $20.14 and $23.70.

Milton, $19.80 and $22.40.

St. Mary's, $25.86 and $34.20.

Stratford, $20.48 and $24.04.

Tavistock, $23.50 and $29.12.

New Hamburg, $22.34 and $26.08.

Baden, $23.91 and $28.06.

Berlin and Waterloo, $17.36 and $19.27.

Guelph, $18.39 and $20.95.

Hespeler, $18.48 and $20.58.

Preston, $17.99 and $19.76.

Galt, $17.35 and $19.13.

Brantford, $16.87 and $18.47.

St. George, $17.14 and $18.62.

St. Thomas, $21.89 and $27.21.

London, $19.51 and $23.03.

Tillsonburg, $24.30 and $31.86.

Ingersoll, $18.81 and $21.93.

Woodstock, $18.26 and $21.11.

Paris, $18.12 and $20.50.

Windsor and Walkerville, $27.13 and $35.47.

Wallaceburg, $30.74 and $42.02.

Dresden, $30.87 and $40.79.

Chatham, $24.62 and $30.15.

Thamesville, $27.83 and $34.43.

Bothwell, $25.45 and $31.11.

Glencoe, $27.04 and $32.90.

Sarnia, $29.28 and $39.91.

Petrolea, $25.52 and $32.47.

Oil Springs, $26. and $33.28.

Alvinston, $27.64 and $34.19.

Strathroy, $27.82 and $36.83.

Capital Required.

The capital cost is estimated in detail for a generating plant at Niagara, including tunnel tail-race, $1,250,000; headworks and canal, wheelpit, power house, hydraulic equipment, electric equipment, transformer station and equipment, office building and machine shop, miscellaneous items, engineering and contingencies and interest, a grand total for twenty-four-hour power of 50,000 h.p. development of $5,786,500; for 75,000 h.p. of $7,019,584, and for 100,000 h.p., $8,631,168. The capital cost per h.p. is, thus, for 50,000 h.p. development, $116; 75,000 h.p., $94; 100,000 h.p., $86. The estimate is based on the best class of construction, the machinery to be of 10,000 h.p. units with one spare machine in each case.

Companies Incorporated

The Yucitan Power Company, Limited, capital stock of $1,000,000, for the purpose of constructing and operating power plants of all kinds. Directors are J. S. Lovell, W. Bain, R. Gowans, S. G. Crawell, J. H. Castles.

The Moffatt Fuel Saver, Limited, has been incorporated under Dominion charter, to carry out and transact all matters comprised in the company's charter of earlier date. N. J. Kerr, civil engineer, of Ottawa, to be its attorney.

The Evans Co., Limited, has been incorporated with a share capital of $100,000, with head office at Sudbury, Ont., to carry on a lumbering and contracting business. The directors are Wm. A. Evans, F. H. Aurie and D. H. Andrees.

The Canadian Athinite Co., Limited, has been incorporated with capital stock of $300,000, with head offices at Toronto, to develop chemical processes under letters patent. Directors are J. S. Lovell, William Bain and Robt. Gowans.

The Hussey Construction Co., Limited, has been incorporated under Dominion charter; total capital stock of $20,000, for the purpose of carrying on a construction business. Directors: H. R. Hussey, W. H. Whitehead, G. E. Hussey, A. Curville and P. Surveyor.

Huron Oil Producers, Limited, has been incorporated with a capital stock of $60,000, to carry on mining operations in connection with oil and gas. The directors of the company are W. McIntosh, J. Brahaney, G. E. Corell; J. A. McIntosh and D. Urquhart, with head office at Petrolea, Ont.

The Chatham Motor Car Co., Limited, has been incorporated with a capital stock of $50,000, to manufacture and deal in gasoline engines and automobiles, with head office at city of Chatham. The directors of the company are R. J. Gardner, R. L. Brackin, P. Dillon, T. K. Helmes and W. J. Taylor.

The Brussels Oil Co. have been incorporated under Ontario charter with a share capital of $100,000, for the purpose of dealing in petroleum oil, natural gas, etc., and sink wells for same. The provisional directors are David Ross, W. L. Holmes, H. L. Jackson and W. M. Sinclair, with head office at Bussels, Ont.

The J. B. Abel & Fils Co., Limited, has been incorporated under Dominion charter; capital stock of $20,000, for the purpose of manufacturing boxes, doors, sashes, furniture, and the manufacture of lumber for trading. The directors are J. O. Ogbott, J. B. Abel, A. Desnoyers, M. Ebhet. Chief place of business, Montreal.

The Federal Colonization & Land Reclaiming Co. has been incorporated under Dominion charter with a capital stock of $500,000, to carry on the business of land reclaiming and improvement. The provisional directors are J. R. Booth, W. Anderson, A. A. Taillon, D. M Finnie, J. W. Hennsey. Chief place of business, Ottawa.

The British & French Motor Car Co., Limited, has been incorporated with capital stock of $50,000, for the purpose of manufacturing and dealing in bicycles, automobiles and motor boats, with head offices at the city of Toronto. The directors of the company are J. C. Palmer, E. E. Palmer, H. N. Baird, E. T. Malone and A. Hearns.

The International Gold Dredging Co. has been incorporated under a Dominion charter with a capital stock of $1,000,000, for the purpose of carrying on mining operations and contract engineering work. The provisional directors are W. H. Roughsedge; R. V. Sinclair, C. M. Farley, A. McFarlane, with chief place of business at Ottawa.

John Millen & Co. have been incorporated under Dominion charter with a capital stock of $100,000 for the purpose of carrying on a wholesale and retail hardware and hardware sundries business. The provisional directors are John Millen, John E. Millen, Wm. Strachan, G. R. Lighthall and F. W. Sharp, with chief place of business at Montreal.

The Mann Brass Manufacturing Co. have been incorporated under Ontario charter, with a share capital of $50,000, for the purpose of manufacturing and dealing in brass goods and plumbing supplies. The provisional directors are Andrew W. Mann, Lila Mann, Charles Dunn, John Howard, Wm. O'Brien and Frederick Higman, with head office at London.

Alphaduct Mfg. Co., Limited, has been incorporated under Ontario Provincial charter, with a capital stock of $40,000, to carry on the business of manufacturing and dealing in electric conduits, and to take over the business now being carried on. Directors of the company are F. B. Johnson, C. W. Bongard and S. Johnson. Head office at Toronto.

Northwestern Brass Co. have been incorporated under Dominion charter with a capital stock of $100,000, for the purpose of manufacturing and dealing in brass castings, railway and foundry supplies, etc. The provisional directors are J. T. Ostell, Peers Davidson, A. Wainwright, F. H. Hewitt and Thornton Davidson, with chief place of business at Montreal.

The Delhi Light & Power Co., Limited, has been incorporated under Ontario Provincial charter, capital stock of $40,000, for the purpose of constructing and operating work for the production, distribution and sale of electricity and gas. The directors are Peter Quance, S. Stroup and R. Quance; G. G. Byers and E. Morgan, of the village of Delhi, Ont.

Jones Underfeed Stoker Co. has been incorporated under Dominion charter with a capital stock of $150,000 for the purpose of manufacturing and dealing in stokers, furnaces, boilers, etc. The provisional directors are C. E. A. Goldman, J. McD. Miller, T. A. Silverthorn, B. A. C. Craig, D. A. Brebner, T. G. McConkey, and A. W. Holmstead, with chief place of business at Toronto.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

J. M. Poirier will start a carding mill at Waterloo.

The Western Bay Company will erect a factory at Calgary.

Fort William will erect an electric light sub-station to cost $10,000.

The Ideal Bedding Co. will increase their factory capacity in Winnipeg.

W. D. Douglass, of Winnipeg will build a sheet iron working factory.

James Murchie Sons Co. will erect a saw mill near Gleason's Cove, N.B.

The McGill Chair Co., of Cornwall, will build a new factory 150x60 feet.

J. Burnside, of Hamilton, will start a sash and door factory at Lethbridge.

J. M. Diver will shortly commence work on a match factory in Sarnia.

The capacity of the McDonald box factory at Peterboro will be increased.

A local syndicate of Eburne, B.C., will erect a glass works at that place.

The Crown Broom Works of Vancouver will build a new factory in that city.

The city of Toronto will purchase an asphalt plant that will cost about $20,000.

The Miramichi Lumber Co. will build mills at Chatham, at a cost of about $50,000.

Toronto will call for tenders for a new pumping station to cost about $12,000.

The Montreal Terminal Cartage Company will build a warehouse to cost $137,000.

The York Radial Railway Co. have commenced work on a new power house at Keswick.

The Cockshutt Plow Co., of Brantford, will make extensive additions to their plant.

The Sabey Lumber Co., Ballard, Wash., will build saw mills an Burrard Inlet, B.C.

The Chatham Fruit Growers' Association will erect a factory and warehouse at that place.

The Grand Trunk will erect a $1,000,000 hotel at Ottawa. Plans are already drawn up.

C. S. Battle, and others, of Vancouver, will erect a big lumber mill on Burrard Inlet, B.C.

A new steel bridge 160 feet long will be built at Doaktown, N.B., by the Intercolonial Railway Co.

Contract has been let for the structural steel to be used in the new steel plant at Welland, Ont.

The Great West Saddlery Company, Winnipeg, will build a factory and warehouse at Saskatoon.

Sault Ste. Marie will submit a by-law to guarantee bonds of a plough company to the extent of $15,000.

The Hudson's Bay Company, of Winnipeg, ask for tenders for a brick boilerhouse and chimney.

The National Trust Co., Toronto, offer for sale the factories and lands lately held by the York Loan Co.

Peter Weiler, of Wetaskiwin, Alberta, is making arrangements to build and run a brewery at that place.

James Sanders will erect a grist mill at Esterhazy, Sask., the town having granted him a bonus of $3,000.

The Sharples Separator Company will erect a factory in Toronto for the manufacture of cream separators.

Wolseley, Sask., will submit a bylaw to raise $20,000 to erect a fire and town hall, and buy fire-fighting apparatus.

The city of Vancouver will buy a large rock quarry to supply municipal works, and will operate it by water power.

The Dexter Mill Co., of Marysville, Washington, are contemplating establishing a shingle mill in Vancouver.

Winnipeg has placed an order for 25,000 barrels of cement with the International Portland Cement Co., of Hull, Que.

A Michigan syndicate has purchased 17 acres of timber land from W. H. Higgins, Eburne, B.C., for a saw mill site.

The Stanley Smelting Works of Bannockburn shipped a carload of pure lead to Toronto recently, which brought $98 per ton.

Joseph Battle, of Thorold, has been awarded the contract for grading for the electric road from St. Catharines to Welland.

The Sawyer-Massey Co. will erect a large warehouse in Hamilton, and the Norton Mfg. Co. will increase their buildings.

The Coast Quarries Co., operating at Burrard Inlet, B.C., is making application to use the Granite Falls for power purposes.

The graphite discovered by Neil L. Campbell, at French Vale, Cape Breton, has been shown to contain 70 per cent. of graphite.

It is reported that the Canadian Locomotive Construction Co. will establish a plant employing 1,500 men at Halifax.

Ross-Harris Company, Montreal, have secured a contract to build 50 miles of C.P.R. road from Parry Sound to Byng Inlet.

J. H. Fryer and others, of Galt, will go into the manufacture of malleable iron castings. They will be capitalized at $100,000.

The Tait-Carss Lumber Co., of Huntsville, Ont., will erect a new dry kiln, and have a railway siding run to their works.

Campbellford, Ont., will submit a by-law to raise $75,000 to erect a new dam and power house, to develop 9,000 horse-power.

The Robertson Machinery Co., of Welland, are about to erect a large new building to accommodate their increasing business.

A large flow of natural gas has been struck south of Hamilton, on the route of the Hamilton, Caledonia & Lake Erie Railway.

The mica mines in Hastings county are being successfully operated, and a large quantity of mica is being marketed from them.

Four new elevators will be built in Weyburn this year by the Dominion, Northern, McKinnon and Weyburn Lumber Companies.

The Ottawa Dairy Co. are installing a plant for the manufacture of skim milk into powder, which is used for many purposes.

A proposal to establish a glass factory at Eburne, a suburb of Vancouver, on the North Arm of the Fraser River, is taking shape.

Waterloo will vote on a by-law to lend $7,500 to the Specialty Knitting Co., of Galt, in order to establish a factory in the former town.

A heavy output of ore is maintained over the whole Kootenay district. The total shipments for the last 12 months were 338,228 tons.

Stephens, Hepner & Co., of Port Elgin, are negotiating with Peterboro' with a view to establishing there. They employ 60 hands.

The Transcontinental Railway Commission will shortly call for tenders for 50,000 tons of 80-lb. rails, and 2,500 tons of angle irons.

The Hamilton Power Company will spend a quarter of a million dollars in increasing its plants at Northfield and Departure Bay, B.C.

Ten thousand men will be needed by J. D. McArthur, of Winnipeg, to carry on the Winnipeg-Superior section of the Grand Trunk Pacific.

William Mackenzie has purchased for $5,000,000 the Conrad mines in British Columbia. These mines were bought last year for $160,000.

The Terminal Warehouse & Cartage Co., Montreal, will erect a building to cost $137,000. The building will be of solid brick, 192 x 99 feet.

A. E. Williams and Crown Attorney

Hart, of Vancouver, are at the head of a company who will build and operate a million dollar pulp mill.

The Belleville Rolling Mills have been sold to J. Wardrope, of Ottawa, who has been acting for a syndicate. New machinery will be installed.

The Dominion Government will erect a ten-story building on Front street, Toronto, next to the Customs House, to be used as a receiving warehouse.

The annual report of the U. S. Steel Corporation, for 1905, just published, shows a gross earning of $585,000,000, and a net earning of $120,000,000.

The oil refinery of the Imperial Oil Company, which was recently destroyed at Sarnia, will be rebuilt at once with increased manufacturing facilities.

The Canadian White Co. are engaged upon an immense work in Montreal in the excavation of ground for a new cold storage property in that city.

Seaman, Kent & Co., Toronto, will establish a factory at Port Arthur to employ from 30 to 50 hands for the manufacture of hardwood flooring.

The Charlottetown Foundry & Machine Co., of Charlottetown, P.E.I., have opened up their new foundry, and make a specialty of heating plants.

Meaford citizens voted a loan to the Georgian Bay Milling and Power Company in order to develop electrical power for lighting and industrial purposes.

The Hillcrest Railway Coal & Coke Co. will apply for a charter to build a railway from Morrissey, B.C., through the Crow's Nest Pass to Cardston, Alta.

The Amherst Foundry Co., Amherst, N.S., have placed an order for a 2½-ton single-beam traveling crane with the Smart-Turner Machine Co., Hamilton, Ont.

The establishing of a fibre factory is contemplated in New Westminster, B.C. The promoters of the concern are the John Doull Miller Company of New York.

The Peterborough Light & Power Co. has offered to furnish Peterborough factories with power up to 2,000 horsepower at the rate of $20.00 per horsepower per year.

The Port Arthur Lime, Sand, Brick Co. are having a plant shipped from John Inglis & Sons, and it is expected that operations will be commenced on June 15.

Stevens, Hepner & Co., brush and broom manufacturers, of Port Elgin, have asked the town to install a waterworks system, otherwise they will go elsewhere.

The Burrill Foundry Company has secured a site in Brantford, and will build a factory thereon. It is expected that everything will be running by the 1st of June.

The Hedley Shaw Milling Company of Thorold, Ont., may locate at Port Colborne if certain trackage and switching privileges are not allowed them by the former town.

The Knechtel people, of Walkerton, will enlarge the Sieling furniture factory to accommodate 25 more hands. The addition will be 50 x 75 feet, three stories high.

The British Columbia Pine Timber Co., of Vancouver, will build a saw mill at Kaien Island, and have a contract to supply 500,000 ties for the Grand Trunk Pacific.

The United States Government will shortly commence the widening of the Soo Canal, which will be the first step in improvements that will amount to over $6,000,000.

Final arrangements have been made for building the Hamilton, Galt and Guelph electric railway. A bridge on the high level across Desjardins Canal will be constructed.

Among recent sales of economizers made by the B. F. Sturtevant Co., Boston, Mass., was an installation of plant of the Hamilton Powder Co., Beloeil Station, P.Q.

O. Dunn, of Peterborough, and Edward Young, of Young's Point, will rebuild and operate the sawmill burnt at the latter point last July. The new mill will be 60 x 22 feet.

Assessment Commissioner Forman, of Toronto, is negotiating with a large American steel company, and a brick manufacturing company, to establish works at Ashbridge's Bay.

It is estimated that the consumption of Portland cement in 1905 was approximately 1,346,548 barrels of home product and 718,275 barrels of imported, or a total of 2,004,823 barrels.

The Keewatin Power Company will offer for sale by auction its developed water power on Winnipeg River, near Kenora, Ont. Sale will take place at Russell House, Ottawa, July 5, 1906.

The Dominion Smelter at Boundary Falls, B.C., will be enlarged by the addition of a new furnace and an expenditure of $20,000 on machinery, which will increase the output to 1,200 tons per day.

The Arizona Camp Bay Co. will install a 125 ton capacity pulverizor in their mills at Kenora. It is claimed that a saving of 50 per cent. will be effected with half the former power used.

The only industrial strike (aside from the telephone operators) which threatened Vancouver this season, that of the carpenters has been averted by a mutual agreement between masters and men.

The city of Calgary has ordered a 400 horse-power cross compound Corliss engine from the Robb Engineering Co. This is a duplicate of an engine installed by that city a few months ago.

The Baker Lumber Company will build a saw mill on the Kootenay river near the mouth of the Elk river in British Columbia. C. D. McNab will be manager, with headquarters at Cranbrook.

The Ingersoll Board of Trade is advertising the industrial possibilities of their town in trade papers, and report many replies, which shows that this method of advertising reaches the persons desired.

Recent explorations in Cape Breton have brought out the reports that some of the richest copper properties in the world have been found there. The Department of Mines has taken up the work of surveying.

Drummond, McCall & Co., sales agents for the Algoma Steel Co., have closed a deal for 50,000 tons of 80-lb. steel rails with the C.P.R. These rails are to be used between Port Arthur and Superior Junction.

Wm. Beech has returned to Winnipeg, after spending several months of exploration up near the Hudson Bay. He reports sections of that country to be rich in iron, mica and plumbago, as well as the precious metals.

Chas. Harrigan, acting for a Spokane syndicate, has taken an eighteen months' bond on the Humming Bird gold-copper property in British Columbia. A force of men will be put on at once to develop this property.

The Grand Trunk has asked the Government to permit 50,000 tons of steel rails to enter Canada free of duty. It is said that the rail mills of Canada have all they can do for twelve months, and are unable to fill this order.

Probably one of the least talked of and yet withal the richest copper properties in Ontario is that of the Massey Mining Company, situated about four miles from Massey, Ont., and about the same distance from the Spanish River.

C. M. Hays, Sir Thomas Shaughnessy, E. H. Fitzhugh, F. H. McGuigan, D. McNicoll, and G. W. Leonard, will seek incorporation as the Toronto Union Station Company, with power to erect a union passenger station at Toronto.

The Brockville Mining Co. is developing the mica mine near Elgin, Ont., and has opened works in Brockville for finishing the product. About twelve people are employed, and the outlook is that the industry will become an extensive one.

The Canada Stove Works at Harriston are getting things in shape at their new foundry. The molding shops, machine shops and fitting room contain the latest improvements, and when completed it will be altogether a well equipped plant.

J. M. Moore, of Portland, Ore., is at the head of a body of men who purpose establishing a cyanide system of treating ores, in Victoria, B.C. The advantage of this process is that ores are treated at the mines instead of being sent to smelters.

J. A. Young, of Sydney, C.B., states that a barbed wire factory will be established at Sydney if the Dominion Government will put a tariff on barbed wire. The new enterprise would be financed by English capital and employ a large number of men.

The Canadian Buffalo Forge Co. are furnishing fans, separators, and complete galvanized iron work for exhausting shavings in E. W. Tobin's new plant

at Bromptonville, Que. Similar equipment is also being furnished to Messrs. J. & G. Jardine Co., Rexton, N.B.

The ironfounders of Hamilton have asked the molders to accept 10 per cent. cut in wages. The employers say that the west, which is the principal market, is being taken by American founders, who are near the market. The molders turned down the proposal, and asked for a 10 per cent. increase.

The Chapman Double Ball Bearing Co., of Canada, has shipped a large order of bearings to the Western Canada Flour Mills Co., St. Boniface, Man. This mill is one of the largest and most modern-equipped flour mills in the world, and is using every modern appliance with a view to economy.

Toronto city council has joined in a petition to the Dominion Government to permit municipalities to obtain control of Bell Telephone lines. The petition also memorializes the Government not to increase the capital of the Bell Company unless the company is willing to submit to municipal regulation and provincial control.

A. Jennings & Co., of Montreal, wagon and carriage builders, have just completed what is considered one of the best equipped shops of its kind in that vicinity. Amongst other apparatus is a 25 h.p. Alexander suction gas plant, supplied by Williams & Dadson, of Montreal, with which they purpose making their own light.

Centrifugal pumps have been installed by the Smart-Turner Machine Co., Limited, in the Canada Coating Mills, Georgetown; the John Whitefield Co., Toronto, and the Magnetewan Tanning & Electric Co., and standard duplex pumps have been ordered by E. Long Mfg. Co., of Orillia; Kerr & Foss, Sherbrooke, Que.; Geo. Roberts & Sons, and H. C. Minette, of Gravenhurst.

Among the boiler contracts at present being filled by the Jenckes Machine Co., of Sherbrooke, Que., is one for a new boiler plant which the A. Gravel Lumber Co., of Etchemin Bridge, Que., is installing. This plant will consist of four 125 h.p. 72-in. diameter by 16 ft. long high pressure tubular boilers, complete with all fixtures and fittings. Smoke breeching and 600 h.p. feet water heater.

S. J. Ritchie, an Ohio capitalist, has made the statement that immense quantities of red, grey and blue granite are to be found near Bancroft, Ont. The deposits were brought to the attention of Thos. Morrison, of Aberdeen, Scotland, who has had a large experience with granite and marble, and he has declared the granite equal to the best imported to this country.

Wm. McNally, head of the big contracting firm of Montreal, has just returned from the Old Country. Foreseeing the shortage in supplies of cement from the United States, and the incident advance of prices, Mr. McNally made arrangements with some of the Old Country manufacturers for supplies, and has chartered several steamers for the transport of cement supplies, which will deliver abundant cargo at Montreal shortly.

A car barn and shops for the B. C. Electric Railway are to be built in Vancouver on a new site in Mount Pleasant, recently purchased. It is the intention at these shops to manufacture not only parts of cars, and repairs, etc., but also to turn out everything possible to make and in common use in the electric business. The company has at present a car shop at New Westminster, where all the cars for their lines are turned out.

The Alberta Railway & Irrigation Co., Lethbridge, has ordered two 175 h.p. Robb-Mumford boilers from the Robb Engineering Co., making the ninth of these they have installed and running. Two of 200 h.p. are being installed in the new I.C.R. roundhouse at Truro, and one of the same capacity in the power plant of the town of Strathcona, Alta., as well as two of 150 h.p. for the station of the Marconi Wireless Telegraph Co., of Glace Bay.

Among recent patents granted in Canada, Fetherstonhaugh & Co., patent solicitors, Montreal and Toronto, are: R. Thompson, governing mechanism for elastic fluid turbines; M. M. Pearson, elastic fluid turbines; J. P. Sinclair, hot water heating system; C. W. Gay, paper box machines; E. A. Mason, wheel guards for railway cars; J. C. Harmer, device for removing frost and steam from windows; J. W. Stanley, vehicle axles; H. E. Moffatt, oil extractors.

J. R. Booth, Ottawa, has placed an order with the Jenckes Machine Co., of Sherbrooke, Quebec, for a water wheel plant to run his new paper mill. The plant will consist of a pair of 48-in. special graduating gate type Crocker turbines, to develop 875 h.p. under 20 feet head, running at 155 r.p.m. The turbines will be mounted on a cast iron draft chest, set in concrete flume. The same company is also building two Port Henry pulp grinders, in addition to seven already furnished Mr. Booth.

A variety of patents have been issued by Marion & Marion, patent attorneys, Montreal, in Canada recently, included among which are: hand-operated spraying device, Hans Mikerov, Berlin; electric incandescent lamp, Otto Feuerlin, Charlottenburg, Germany; explosives, Gustav Reschke, Hamburg, Germany; air and gas mixer, G. Graap, Berlin, Germany; rail cleaner, H. Quiertier, Dunedin, New Zealand; hydraulic clutch, George Sparks, Fairview, England; lead and silver recovering process, J. Asbeck, Germany.

The Canadian Chrome Co., of Thetford Mines, are installing an additional 10 stamps in their stamp mill, which will give it 20-stamp capacity. Since commencing operations about a year ago this company have met with excellent success in marketing their product, which is of an especially fine grade of chrome iron concentrates, hence the present increase of plant. The additional equipment was furnished complete by the Jenckes Machine Co., of Sherbrooke, Que., who were also contractors for the first 10 stamps.

The Lake Superior Corporation and the Dominion Iron & Steel Company, have announced that they will both tender for the contract for 50,000 tons of steel rails to be awarded by the National Transcontinental Commission. As the rails are for this year's delivery it was thought that the Canadian companies would not be able to take the order. It is probable that the contract will be divided between the Canadian companies, as with the tariff they can quote a lower figure than the English manufacturers, who are the closest competitors.

The Canadian Buffalo Forge Company, in Montreal, are rushed making air washers, and are at present installing six very large ones for purifying and humidifying air supplied for ventilation. The system consists of a spray through which the air passes and an arrangement of baffle plates, removing the moisture and dirt with it. With this equipment it is claimed that no matter how dusty the source of supply, the air entering the building will be pure, fresh and properly moistened. An attachment is furnished for automatically controlling the temperature in the spray chamber, thus automatically determining the humidity.

Work on the new municipal electric lighting plant for Drummondville is about to commence. The Standard Construction Co., of Montreal, have the contract. The contract for the hydraulic machinery has been sublet to the Jenckes Machine Co., of Sherbrooke, Que., and the contract for the generator has been sublet to the Canadian General Electric Co., Toronto. The water wheel plant will be composed of one 55-in. special Crocker turbine, vertically set in steel case and complete with gearing, bridgetrees, shafting, etc. Under 11 feet head the turbine will develop 240 h.p. at 90 r.p.m. The generator will be of 150 k.w. capacity.

The hoisting engine equipment of the Asbestos & Asbestic Co., Asbestos, Que., near Danville, has been increased this Spring by the addition of four 9 x 12 special cableway hoisting engines, as built by the Jenckes Machine Co., of Sherbrooke, Que. This hoisting engine was designed especially for cableway service, having one drum for hoisting purposes and a separate independent drum for operating the carriage on the cable. It has been extensively adopted by the asbestos mines in the Province of Quebec, also to considerable extent by the coal mines in Alberta. The Johnson's Company, of Thetford Mines, have lately installed two of these engines.

The Northern Electric & Mfg. Co. have just about completed one of the largest and best equipped manufacturing plants in Montreal. In their cabinet shop, equipped some months ago, they had installed 79 Chapman double ball bearings, and for the main plants recently completed they have ordered 140 more. Other firms to adopt these bearings in their plants with a view to using the most modern methods available are the Canadian Fairbanks-Morse Mfg. Co., the London Machine Tool Co., Hamilton; the Hamilton Cotton Co.; the Singer Mfg. Co., St. Johns, Que.; the Canadian Copper Co., Copper Cliff, Ont.; and the Oshawa Steam & Gas Fitting Co.

The 250 h.p. electric hoist which was built for the Granby Smelter, at Phoe-

nix, B.C., by the Jenckes Machine Co., of Sherbrooke, Que., has recently been shipped. The fact that this hoist has been built by a Canadian firm is noteworthy, as heretofore electric hoists of large size have been regularly imported from the United States. The hoist has two conical drums, each 8½ feet diameter at large end, 5 feet diameter at small end and 5½ feet long, both drums being capable of independent operation through the medium of powerful friction clutches. The capacity of the hoist is a load of 10,000 lbs. on either drum at 500 feet per minute, and the shipping weight in the vicinity of 50,000 lbs.

Kaien Island, the much-exploited and much-advertised, and supposed terminus of the Grand Trunk Pacific in the east is the site chosen for the location of a mill by the B. C. Pine Timber Co., an organization recently formed here, and which has as a starter an order to cut 500,000 ties for th new transcontinental line. W. D. Hays, a brother of the general manager of the G. T. P., associated with a number of local men, is interested in the mill. The machinery for the mill has been ordered from the east and will be forwarded to Kaien Island as quicly as it arrives, for the contract for ties is for early delivery and it is anticipated that work on cutting them will begin by mid-summer..

Recent installations by the McEachran Heating & Ventilating Co., Galt, Ont., include lumber dry kilns for Sherlock-Manning Organ Co., London, Ont.; Dyment-Baker Co., London, Ont.; New Glasgow Mfg. Co., New Glasgow, N.S.; A. McDonald Co., Peterboro; cloth dryers for Medicine Hat Woolen Mills Co., Medicine Hat, Assa.; brick dryers for Imperial Land Co., Sturgeon Falls, Ont.; blast heating systems for W. A. Greene & Co., Waterloo, Ont.; Belleville Portland Cement Co., Belleville; Imperial Paper Mills Co., Sturgeon Falls, two mills; Dyment-Baker Co., London; planing mill exhaust systems for Ottawa Lumber Co., Ottawa, Ont.; Laverdue & Sons, Ottawa, Ont.; Dyment-Baker Co., London, Ont.; London Box Co., London, Ont.; Cushine Bros., Regina, N.W.T.

After a short cessation of operations the Laurie Engine & Machine Co., Limited, of Montreal, known from Sydney to Vancouver as manufacturers of the Laurie Corliss engine, has renewed operations with increased energy. The officials of the company are: President, Wm. Yuile, vice-president, David Yuile; managing director, Herbert Yuile; secretary-treasurer, A. D. Madley; directors, C. E. L. Porteous, C. W. Davis, William Davis, H. Yuile and Alex. Ross, superintendent. With the addition of new energy and fresh capital, and the thorough requipment of the firm in all its departments, the Laurie Engine & Machine Co. are prepared to go ahead on a larger scale than in the past and manufacture, besides the former lines, big castings for structural work and all kinds of contractors' supplies. Some of the corporations in Canada that have installed Laurie engines include the Montreal Street Railway Co., the Winnipeg Electric Street Railway Co., Toronto Railway Co., the Dominion Iron & Steel Co., the Canadian Rubber Co., Gazette Printing Co., Merchants' Cotton Co., Windsor Hotel, Montreal; Ogilvie Flour Mills Co., Canadian Pacific Railway Co., British Columbia Electric Railway Co., Linde British Refrigeration Co., Montreal Light, Heat & Power Co., and many others equally important.

Enterprise Foundry Enlargements.

The Enterprise Foundry at Sackville, N.B., in which Messrs. Emerson & Fisher, of St. John, N.B., are largely interested, is to be further enlarged. A short time ago it became necessary to enlarge the foundry and now increasing business has made an addition to the warehouse and the erection of a new office building necessary. It is expected that the new buildings will be ready for occupancy in July. The addition to the present warehouse will give the foundry a three-storey warehouse 160 x 40 feet. The new office building will be a two-storey structure 40 x 35 feet, fitted with a vault and all the latest conveniences.

New Construction Company.

A new construction company has been formed at Montreal, under the name of the Smith Marble & Construction Co., with a capital of $40,000. The company obtained a Federal charter and it has been decided to erect a large factory, ground for this purpose having been secured at Cote St. Louis. The new building will be two storeys high and of large proportions, the approximate cost being fixed at $10,000. They will contract for interior marble, concrete and cement flooring, tiling and general construction work, giving employment to a large staff of workmen. The officers of the company include D A Campbell, president; W. J. Henderson, secretary; A. L. Smith, treasurer; Peter Smith, managing director.

Foundry Convention.

The tenth annual convention of the American Foundrymen's Association is to be held in Cleveland, Ohio, June 5, 6 and 7. For this convention an attractive programme has been arranged, and everything points to a most successful convention. The annual gathering of the Associated Foundry Foremen will take place in Cleveland on the same days, beginning with June 4. Joint sessions will be held during the week, and both associations will take part in the various excursions arranged.

Change in Tool Business.

The Cincinnati Lathe & Tool Co. have recently purchased the lathe business of the Fosdick Machine Tool Co., of that city. The plant is situated in the heart of the machine tool district and is in full running order. The president of the company, Mr. W. C. Heindel, was connected with the Cincinnati Milling Machine Co. for the past ten years, and the superintendent, Mr. A. B. Sowden, has been building lathes for the past twenty years.

New Blast Furnace.

The capitalists behind the Canadian General Electric Co. and Canada Foundry Co. propose to organize a million dollar company to erect blast furnaces on the Niagara Peninsula to work in connection with the shipbuilding yards at Bridgeburg and supply material to the Canada Foundry and other enterprises closely allied to the parent concern. The difficulty in securing pig iron, now that the manufacture of steel rails has been taken up in Canada, and the prevailing high prices have, it is understood, much to do with the proposed enterprise. The projected furnaces will probably have an output of 200 tons a day at first, and of this, the Canada Foundry Co. would need one-half. The new company will likely be formed at once, and as the Niagara Peninsula is to be the location, the electric process of smelting may be used. The shipbuilding yards at Bridgeburg are being rushed to completion, in order that the owners, the Canadian Shipbuilding Co., may get to work immediately on the construction of the largest steamers ever built in Canada. One is a 10,000-ton steel freight steamer for the Chicago and St. Lawrence Transportation Co., and the other is a new palace steamer for the Canadian Pacific Railway for use on the upper lakes, possibly the new Victoria Harbor route.

Automobile Exhibition.

The Automobile and Motor Show held in the Granite Rink, Toronto, was such a pronounced success that it has been decided to make it an annual affair, and also national in character. Two rinks were utilized for the purpose, both being handsomely and artistically draped with bunting, while during both the afternoon and evening music was furnished by an orchestra in each of the galleries. In one department was included the launches and automobile accessories, gasoline engines and supplies of all kinds, while in the other building the automobile show proper was carried on. Excellent exhibits were shown by a large number of firms, noticeable among which were the Canadian General Electric Co.'s electrical display, the Toronto gas and gasoline engine exhibit, the demonstration of the Chapman double ball bearing, Queen City Oil Co., the Defiance Iron Works of Chatham, Walter Nicholls Motor Boat Co., and many others.

Beautiful Calendars.

The monthly calendars being issued by the Allis-Chalmers-Bullock, Limited, are attracting considerable attention and coming in for a good deal of favorable notice. Those who have been fortunate enough to secure a set to date will no doubt appreciate them and keep each number, containing, as it does, the crest of one of the provinces of the Dominion of Canada in a gold and colored design. The April calendar has on it the crest of Nova Scotia. A card to the publicity department of this firm at Montreal will bring copies of this calendar to any reader of Canadian Machinery.

The Pembroke Electric Co. have recently awarded contracts for the machinery for their new power plant on the Black River, a few miles from Pembroke. The hydraulic plant consists of two 900 horse-power units, each composed of one special 30 in. cylinder, Gate-Crocker turbine, operating under 120 feet head. Each wheel will be enclosed in a steel case 7 feet in diameter, made of ½ in. plate, fitted with heavy cast iron discharge elbow, both units substantially mounted on steel girders, and complete with draft tubes, etc., and two Lombard Type "B" water wheel governors. The water will enter both cases from underneath, a gate valve being placed in each inlet pipe. The water wheel runners will be made of bronze, and each wheel will be direct connected to a 500 k.w. alternating current 3-phase Westinghouse revolving field generator. For driving the exciters there will be provided two 15 in. turbines, each enclosed in steel case and each developing about 50 horse-power. These wheels are also built with bronze runners. Under 120 feet head they run 900 r.p.m., and will be direct connected to the exciters. The hydraulic machinery is being furnished complete by the Jenekes Machine Co., of Sherbrooke, Que., and the order for the generators and exciters has been placed with the Canadian Westinghouse Co., Montreal.

To Electrify the C. P. R.

As soon as the officials of the Canadian Pacific Railroad are satisfied with the results of the experiments being carried on by the New York Central and other American railways in connection with their electrification over certain districts, it is intended to proceed at once with adopting the electric system over the trunk lines on parts of the route where water power is available. While other railways have been expending enormous sums experimenting, they have proven beyond contradiction the utility of the electric locomotive and its obvious advantage over the steam engine for fast runs and frequent service. Both direct and alternating current systems have been adopted, and when the company is able to decide between these work will be proceeded with. It is intended to electrify the line between Montreal and Quebec in the first instance, and later to carry the principle to other lines.

An Ambitious Town.

A quiet development is going on all over the Province of Ontario, manufacturers without exception being almost taxed to capacity to keep abreast of orders, and accordingly expansion is the serious problem confronting them all. Of all the towns and cities which are feeling the impulse of new life, perhaps Galt stands in the very forefront. One has but to visit that busy, hustling, conservative but progressive town to be impressed by the boom that appears to have struck the place, and not only it but the chain of Waterloo county municipalities connected by electric railway —Galt, Preston, Berlin and Waterloo. Galt has several new industries starting this Summer, the most important of which is a malleable iron foundry, now being erected, and to begin operations about the first of June with about eighty hands. At the head of it as managing director is Mr. J. H. Fryer, for years of the firm of Thomas Todd & Son, export hay and grain dealers, and this year's president of the Galt Board of Trade, as well as an alderman, while in the company are some of the wealthiest men in the town and district. Another interesting industry the town has secured, which will make a departure from the iron industries for which the place is noted, is a whitewear factory, which will be in operation within a month. (50 hands). Several smaller industries are being organized, and the influx of labor to all these will mean the erection of several score of houses. At the present time there is not an empty house in the place, even single rooms being rented above stores and offices, and rents are advancing steadily, these features being, of course, characteristic of all growing places. It is probable that steps will be taken within a few days by the board of trade to have workmen's houses erected in large numbers. Last Summer P. W. Gardiner & Son began the erection of a modern planing mill, and it is now just completed, which will facilitate the putting up of houses at the lowest possible cost.

Recognizing the importance of Galt as a manufacturing point, the Canadian Pacific Railway last year converted it into a divisional point, expending over $40,000 on the improvement of its property there, and having acquired a controlling interest in the Galt, Preston & Hespeler Electric Railway, and the Preston & Berlin Electric Railway, which has freight privileges, it has given that road access to "Busy Berlin" as well. Galt is connected by electric railway with Brantford and Paris, to the south, and another road is being mooted to Hamilton and Guelph. A by-law granting street railway switches to manufacturers was passed by three to one on the 5th of April, and this is but an indication of the liberal policy which the people entertain toward manufacturers, and which is quite a change from the spirit of a few years ago. The board of trade, which is one of the most active boards in the country, is largely responsible for the new sentiment, and friends of the good Scotch town will be glad to know that it is making progress so substantially all along the line.

Vancouver City Council is to spend $6,000 in buying water meters to place on the pipe lines of all users except residences. It is found that some disproportionate rates are paid, and to make it nearer the fair thing for all for other than domestic purposes, meters are to be put on. Hitherto practically the only concerns having meters on their mains were the mills and other large manufactories, especially where steam power was generated.

CONTENTS

About Catalogues 200
At the Noon Hour 199
Book Reviews 195
Card Index for Follow Up System 183
By W. H. Stevens.
Companies Incorporated 202
Construction and Improvement.... 173
Driving Gear of Wood Planing Machine 187
By T. C. Robertson.
Editorial 174
Electric Power for Ontario 176
Engineering News 201
Foundry Practice 181
A Talk on Foundry Chemistry.
By H. L. Bowers, B.S.
Venting of Cores.
By Jas. A. Murphy.
Making a Nine Foot Valve.
By Robt. Shirley.
Industrial Progress 203
Making a Pair of Involute Gears.. 186
By John Carr.
Machinery Development 196
Special Portable Milling Machine.
New Crescent Angle Band Saw.
Chain Making by Machinery.
Continuous Feed Glue Jointer.
Victor Pipe Machine.
Short History of an Important Tool.
125 Tons Metal in Single Casting.
Mechanical Reviews 178
Recutting Stripped Nut at Sea.
Repairing Bent Piston Rod.
Improvement in Foundry Work.
Greater Economy for the Gas Engine.
Screw Clamp with Adjustment.
Modern Canadian Manufacturing Plants . 169
New Foundry, John Bertram & Sons, Limited, Dundas.
Power and Transmission 192
Large Compound Air Compressor.
Small Power Motors.
The Pneumatic Motor.
Trackless Trolley System.
Practical Questions and Answers... 191
The Late John Bertram 189

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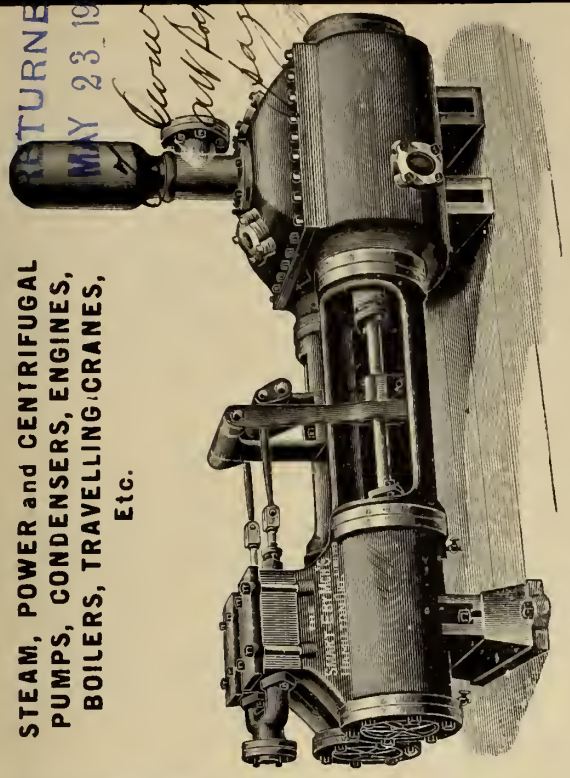

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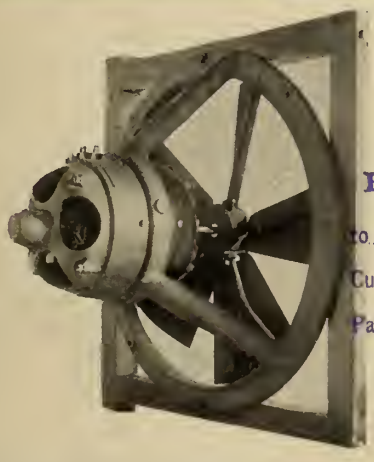

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Canadian Westinghouse Co.. Hamilton.

Electrical Supplies.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
London Mach. Tool Co., Hamilton, Ont.
Packard Electric Co.. St. Catharines.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Electrically-Driven Tools and Machinery.
Allis-Chalmers-Bullock, Montreal.
American Tool Works Co., Cincinnati.
John Bertram & Sons, Dundas.
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Canadian Westinghouse Co., Hamilton.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Electrical Repairs.
Canadian Westinghouse Co., Hamilton
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

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Hamilton Facing Mill Co., Hamilton.

Emery Wheel Dressers.
Diamond Saw & Stamping Works, Buffalo
H. W. Petrie, Toronto.
Standard Tool Co., Cleveland.

Emery Wheel Dressers. Cutters.
Diamond Saw & Stamping Works, Buffalo.

Engineers and Contractors
Canadian White Co., Montreal.
D'Olier Engineering Co., New York.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Link-Belt Eng. Co., Philadelphia.
The Smart-Turner Mach. Co., Hamilton.

Engineers' Supplies.
Rice Lewis & Son, Toronto.

Engines, Gas and Gasoline.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
The Goldie & McCulloch Co., Galt, Ont.
The Sylvester Mfg. Co., Lindsay, Ont.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.

Engines, Marine.
Dominion Rock Drill Co., Napanee.

Engines, Steam.
Allis-Chalmers-Bullock, Montreal.
D'Olier Engineering Co., New York.
The Goldie & McCulloch Co., Galt, Ont.
E Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
John McDougall Caledonian Iron Works, Montreal.
Laurie Engine & Machine Co , Montreal.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.
Waterous Engine Works Co., Brantford.

Exhaust Fans.
Hamilton Facing Mill Co., Hamilton.

Exhaust Heads.
Sheldon's Limited, Galt, Out.
B. F. Sturtevant Co., Hyde Park, Mass.

Expanded Metal.
Expanded Metal and Fireproofing Co. Toronto

Expanders.
A. B. Jardine & Co., Hespeler, Ont.

Fans, Electric.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Sheldon's Limited, Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Fans, Exhaust
Sheldon's Limited, Galt. Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Feed Water Heaters.
The Smart-Turner Mach. Co., Hamilton.

Files and Rasps.
Rice Lewis & Son, Toronto.
Nicholson File Co., Providence, R.I.
H. W. Petrie, Toronto.

Fillet, Pattern.
Hamilton Facing Mill Co., Hamilton

Fire Apparatus
Waterous Engine Works Co., Brantford.

Fire Brick and Clay.
Hamilton Facing Mill Co., Hamilton.

Flash Lights.
Berlin Electrical Mfg. Co., Berlin, Ont.

Flour Mill Machinery
Allis-Chalmers-Bullock Co., Montreal.
The Goldie & McCulloch Co., Galt, Ont.
Ottawa Steel Castings Co., Ottawa.

Flue Rollers.
Chicago Pneumatic Tool Co., Chicago.

Forges.
Allis-Chalmers-Bullock, Montreal.
Boynton & Plummer, Worcester, Mass.
Hamilton Facing Mill Co., Hamilton.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

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H. W. Petrie, Toronto.
St. Lawrence Supply Co., Moutreal.

Forging Machinery.
John Bertram & Sons Co , Dundas, Ont.
Loudon Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio
Niles-Bement-Pond Co., New York.

Founders.
The Smart-Turner Mach. Co., Hamilton

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Link-Belt Eng. Co., Philadelphia.
McLean & Sophus, Montreal.
Ottawa Steel Castings Co., Ottawa
Sylvester Mfg. Co,, Lindsay, Ont.

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Hamilton Facing Mill Co., Hamilton.

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D'Olier Engineering Co., New York.
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Gas Plants, Suction
Power & Gas Machine Co., Galt.
Sylvester Mfg. Co., Lindsay, Ont.
Power and Gas Mach. Co., Limited, Galt.
Wayland, Williams & Dadson, Montreal.

Gauges, Standard.
Brown & Sharpe, Providence, R.I.
McLean & Sophus, Montreal.
Pratt & Whitney Co., Hartford, Conn.

Gear Cutting Machinery.
Becker - Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cincinnati.
Brown & Sharpe, Providence, R.I.
Canada Machinery Agency Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co , Hartford. Conn.
Williams & Wilson, Montreal.

Gears, Angle.
Brown & Sharpe, Providence, R.I.
Chicago Pneumatic Tool Co., Chicago.
Laurie Engine & Machine Co., Montreal
Ottawa Steel Castings Co., Ottawa.
Waterous Engine Co., Brantford.

Gears, Reducing.
Brown & Sharpe, Providence, R.I.
Chicago Pneumatic Tool Co., Chicago.
Ottawa Steel Castings Co., Ottawa.

Generators, Electric
Allis-Chalmers-Bullock, Montreal.
Canadian General Electric Co., Toronto
Canadian Westinghouse Co , Hamilton.
D'Olier Engineering Co., New York.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.

Generators, Gas.
H. W. Petrie, Toronto.

Graphite.
Hamilton Facing Mill Co., Hamilton.

Grinders, Centre.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinders, Cutter.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.

Grinders, Drill.
Wilmarth & Morman, Grand Rapids, Mich

Grinders, Tool.
Armstrong Bros. Tool Co., Chicago.
B. F. Barnes Co., Rockford, Ill.
Brown & Sharpe, Providence, R.I.
Canada Machinery Agency, Montreal.
H. W. Petrie, Toronto.
The Stevens Co., Galt, Ont.
Williams & Wilson, Montreal.
Wilmarth & Morman, Grand Rapids, Mich

Grinding Machines.
Brown & Sharpe, Providence, R.I.
The Canadian Fairbanks, Montreal.
Niles-Bement-Pond Co., New York.
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To Can Manufacturer
our book 49
page 49

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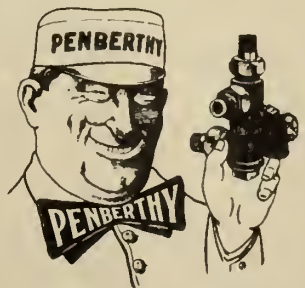

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Hammers, Steam.

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Chicago Pneumatic Tool Co. Chicago.

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B. F. Barnes Co., Rockford, Ill.

Lathes, Screw Cutting.

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London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Bench.

B. F. Barnes Co., Rockford, Ill.
London Mach. Tool Co., London, Ont.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Turret.

American Tool Works Co., Cincinnati.
John Bertram & Soos Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
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The Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.

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Canadian Rand Drill Co., Montreal.

Locomotives, Electrical.

Canadian Westinghouse Co., Hamilton

Locomotives, Steam.

Canada Foundry Co., Toronto.
Canadian Rand Drill Co., Montreal

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Wm. W. Nugent & Co., Chicago.

Lubricator, Plumbago.

Hamilton Facing Mill Co., Hamilton.

Lumber Dry Kilns.

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Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

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Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
St. Lawrence Supply Co., Montreal.
Machinery Exchange, Montreal.
Ottawa Steel Castings Co., Ottawa.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
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The Smart-Turner Mach. Co., Hamilton.
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Rice Lewis & Son, Montreal.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
L. S. Starrett Co., Athol, Mass.
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Mandrels

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Standard Tool Co., Cleveland.

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Mechanical Draft.

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Meters, Electrical.

Canadian Westinghouse Co., Hamilton.

Mill Machinery

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Jenckes Machine Co., Sherbrooke, Que.
Ottawa Steel Castings Co., Ottawa.
H. W. Petrie, Toronto.
Waterous Engine Co., Brantford.
Williams & Wilson, Montreal.

Milling Attachments.

Becker-Brainard Milling Machine Co., Hyde Park, Mass.
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Brown & Sharpe, Providence, R.I.
Niles-Bement-Pond Co., New York,
Pratt & Whitney, Hartford, Conn.
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Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Milling Machines, Universal.

American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
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Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
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Williams & Wilson, Montreal.

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Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
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Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
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Pratt & Whitney Co.. Hartford, Conn.
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The Stevens Co., Galt, Ont.

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The Dodge Mfg. Co., Toronto.
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Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Ottawa Steel Castings Co. Ottawa.
T. & H. Electric Co., Hamilton.

Model Tools.

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Motors, Electric.

Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The Packard Electric Co., St. Catharines.
B. F. Sturtevant Co., Hyde Park, Man.
T. & H. Electric Co., Hamilton.

Motors, Air.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Molders' Supplies.

Hamilton Facing Mill Co., Hamilton.

Molding Sand.

Hamilton Facing Mill Co., Hamilton.

Nippers, Stay Bolt.

Chicago Pneumatic Tool Co., Chicago.

Nut Tappers.

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London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.

Oatmeal Mill Machinery.

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Wm. W Nugent & Co., Chicago.

Oils, Core.

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Marion & Marion, Montreal.
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Patterns.

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Dominion Rock Drill Co., Napanee, Ont.
Hamilton Pattern Works, Hamilton.
Ottawa Steel Castings Co., Ottawa.
The Stevens Co., Galt, Ont.
Wells' Pattern and Model Works, Toronto.

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London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

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Planers, Standard.

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The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Planers, Rotary.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Power Plants.

The Smart-Turner Mach. Co , Hamilton.

Planing Mill Fans.

Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Man.

Plug Drillers, Pneumatic

Canadian Rand Drill Co., Montreal.

Plumbago.

Hamilton Facing Mill Co., Hamilton.

Pneumatic Tools.

Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Hamilton Facing Mill Co., Hamilton.

Presses, Drill.

American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.

Presses, Drop

E. W. Bliss Co., Brooklyn, N.Y.
Niles-Bement-Pond Co., New York

Presses, Hand.

E. W. Bliss Co., Brooklyn, N.Y.

Presses, Hydraulic.

Jenckes Machine Co., Sherbrooke, Que.
John Bertram & Sons Co., Dundas, Ont.
Laurie Engine & Machine Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Presses, Power

E. W. Bliss Co., Brooklyn, N.Y.
Jenckes Machine Co., Sherbrooke, Que.
London Mach. Tool Co., Hamilton. Ont.
Niles-Bement-Pond Co., New York.

Pulp Mill Machinery.

Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.

Pulleys.

Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
The Dodge Mfg. Co., Toronto.
The Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Link-Belt Eng. Co , Philadelphia.
Ottawa Steel Castings Co., Ottawa.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Williams & Wilson, Montreal.
Waterous Engine Co., Brantford.

Pumps, Steam.

Allis-Chalmers-Bullock Montreal.
Canada Foundry Co., Toronto.
D'Olier Engineering Co., New York.
The Goldie & McCulloch Co., Galt.
John McDougall Caledonian Iron Works, Montreal.
H. W. Petrie, Toronto.
St. Lawrence Supply Co., Montreal.
The Smart-Turner Mach. Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.
Waterous Engine Co., Brantford.

Pumping Machinery.

Canada Machinery Agency, Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
D'Olier Engineering Co., New York.
Laurie Engine & Machine Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
St. Lawrence Supply Co., Montreal.
The Smart-Turner Mach. Co., Hamilton.

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Butterfield & Co., Rock Island.
The Globe Machine and Stamping Co., Cleveland, Ohio.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.
H. W. Petrie, Toronto.

Punches, Power.

John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Punches, Turret.

London Mach. Tool Co., London, Ont.
Taylor & McKenzie, Guelph.

Punching Machines, Horizontal.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Quartering Machines.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.

Rapping Plates.

Hamilton Facing Mill Co., Hamilton.

Reamers.

Wm. Abbott, Montreal.
Brown & Sharpe, Providence, R.I.
Butterfield & Co., Rock Island.
A. B. Jardine & Co., Hespeler, Ont.
Ottawa Steel Castings Co., Ottawa.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
The Stevens Co., Galt, Ont.

Reamers, Steel Taper.

Butterfield & Co., Rock Island.
Chicago Pneumatic Tool Co., Chicago.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.

Rheostats

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
T. & H. Electric Co., Hamilton.

Riveters, Hydraulic.

London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Rolls, Bending.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Rotary Converters.

Canadian Westinghouse Co., Hamilton

Safes

The Goldie & McCulloch Co., Galt, Ont.

Sand Blast Machinery.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Sand Sifters.

Hamilton Facing Mill Co., Hamilton.

Saw Gummers.

A. B. Jardine & Co., Hespeler, Ont.
Waterous Engine Co., Brantford

Saw, Hack Frames.

Diamond Saw & Stamping Works, Buffalo
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London Mach. Tool Co., Hamilton, Ont.
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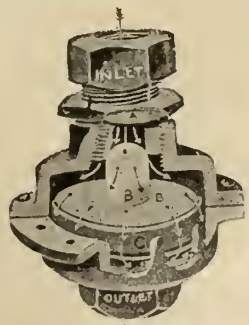

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ALPHABETICAL INDEX.

A

Abbott, Wm. 71
Allis-Chalmers-Bullock Co. ..... Outside back cover
American Tool Works Co 6
Armstrong Bros. Tool Co 76

B

Barnes, B. F., Co 15
Banfield, W. H., & Sons 7
Becker-Brainard Milling Machine Co. . 16
Berlin Electrical Mfg. Co 69
Bertram, John, & Sons 6
Bickford Drill & Tool Co 13
Bliss, E. W., Co 77
Boynton & Plummer 7
Brandeis, Charles 65
Brown & Sharpe Mfg. Co 72
Budden, Hanbury A. 65
Butterfield & Co 74

C

Canada Foundry Co 61
Canada Machinery Agency 8
Canadian Pneumatic Tool Co 79
Canadian Press Clipping Bureau 65
Canada Chemical Mfg. Co 5
Canadian Buffalo Forge Co 9
Canadian Fairbanks Co 20
Canadian Rand Drill Co 78
Canadian Westinghouse Co 1
Canadian White Co 79
Carr, John 67
Carter Publishing Co 67
Chadwick Bros 67
Chapman Ball-Bearing Co 11
Clark-Demill Co 17
Cleveland Automatic Mach. Co 15

D

DeCew, J. A 65
Diamond Saw and Stamping Works 63
Dillon A., & Son 67
Dodge Mfg. Co 10
D'Olier Engineering Co 4
Dominion Belting Co. 63
Dominion Rock Drill Co. 69
Dominion Sewer Pipe Co. inside back cover

E

Economical Mfg. and Supply Co 5
Electric Blue Print Co 65
"Electrical Times" 63
"Engineering" 4
Engineering Specialties Co 67
"Engineering Times" 63
Expanded Metal and Fireproofing Co. 71

F

Fetherstonhaugh & Co 65
Fetherstonhaugh & Blackmore 65
Fielding, John S 65

G

Geometric Tool Co 76
Goldie & McCulloch Co 1
Greening, B., Wire Co 69

H

Hamilton Facing Mills Co 73
Hamilton Pattern Works 67

J

Jardine, A. B., & Co 72
Jenckes Machine Co. 15
Jessop, Wm., & Sons 71

K

Ker & Goodwin 71
Kerr Turbine Co. 4

L

Laurie Engine Co 3
Leonard, E., & Sons 69
Lewis, Rice & Son 77
Link-Belt Eng. Co 11
London Machine Tool Co 14

M

McDougall, R., & Co 16
McDougall, John, Caledonian Iron Wks 2
McEachern Heating & Ventilating Co. 9
McLachlan Gasoline Engine Co 69
McLean & Sophus 78
Marion & Marion 65
Maxwell & Sons 63
Merrell Mfg. Co 77
Morang & Co., Limited 61
Morrow, John, Machine Screw Co. 73
Morton, B. K., & Co 71

N

National Machinery Co 69
New Process Twist Drill Co 70
Nicholson File Co 72
Nugent, Wm. W., & Co 67

O

Otis-Fenson Elevator Co. inside back cover
Ottawa Steel Castings Co 71

P

Packard Electric Co 80
Parke, Roderick J 65
Penberthy Injector Co 63
Pendrith Mach. Co 67
Petrie, H. W 12
Pilkington, Peter, Limited 7
Pratt & Whitney Co. ..... inside front cover
Pringle, T., & Son 65

R

Remington Typewriter Co 69
Ridout & Maybee 65
Robb Engineering Co 3
Rubbra, Alfred 64

S

Sadler & Haworth 66
Sells Commercial 70
Sheldon's Limited 8
Siegwartbeam Co 70
Smart-Turner Machine Co 61
Standard Bolt and Screw Co 73
Standard Tool Co 11, 77
Standish, W. T. 7
Starrett, L. S., Co 74
St. Clair Bros 67
Stevens Co. of Galt 74
St. Lawrence Supply Co 73
Sturtevant, B. F., Co 8
Spon & Chamberlain 72
Sylvester Mfg. Co 4

T

Taylor & McKenzie 70
Technical Pub. Co 80
Tees & Persse 57
Toronto and Hamilton Electric Co 79
Toronto Plate Glass Importing Co 67

U

Underwood, H. B., & Co 15
Union Drawn Steel Co 70

V

Volta Electric Repair Works 78

W

Waterous Engine Works Co. 2
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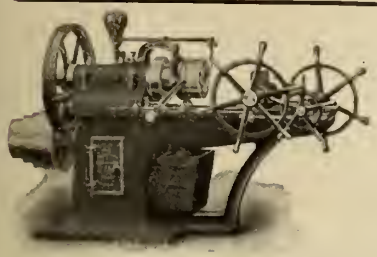

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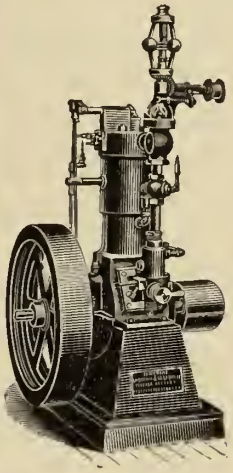

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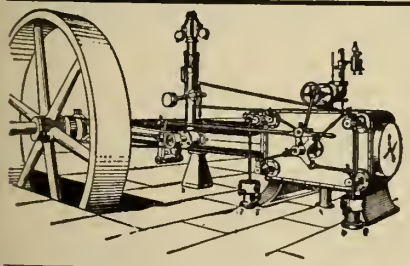

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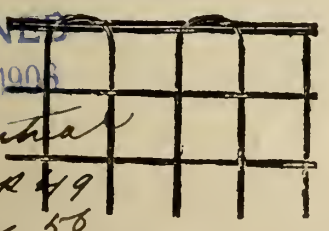

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page 56

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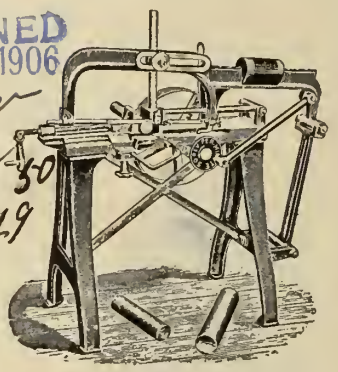

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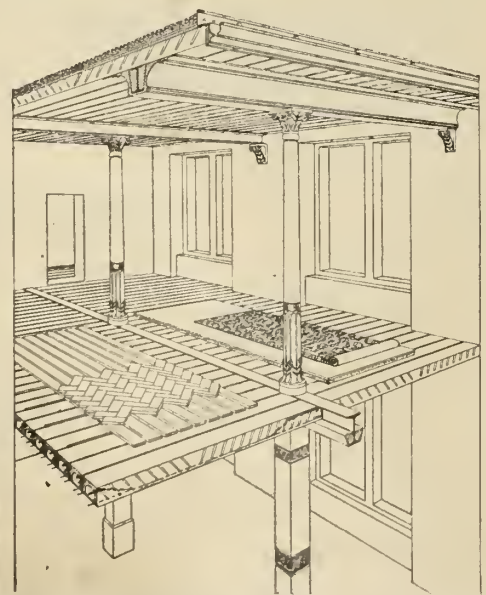

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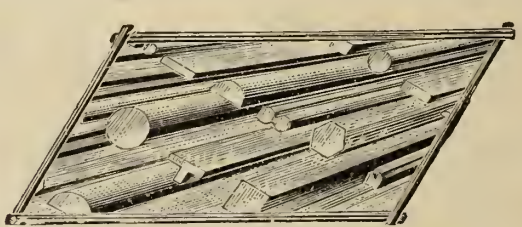

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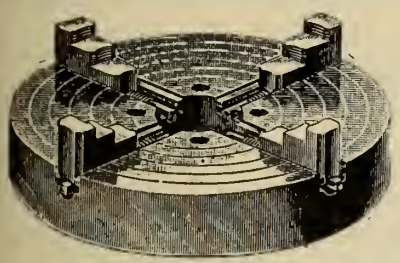

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Features of the Feed Box on a

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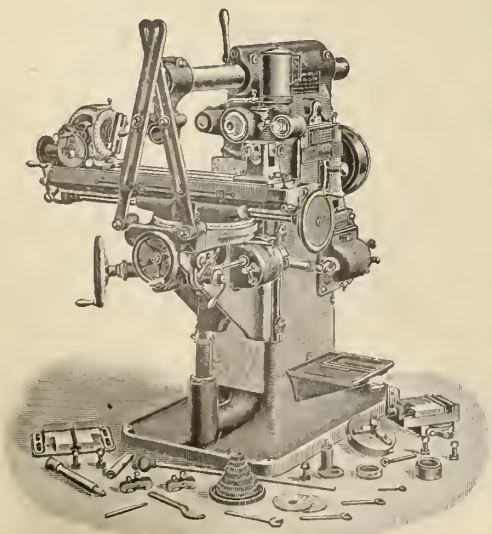

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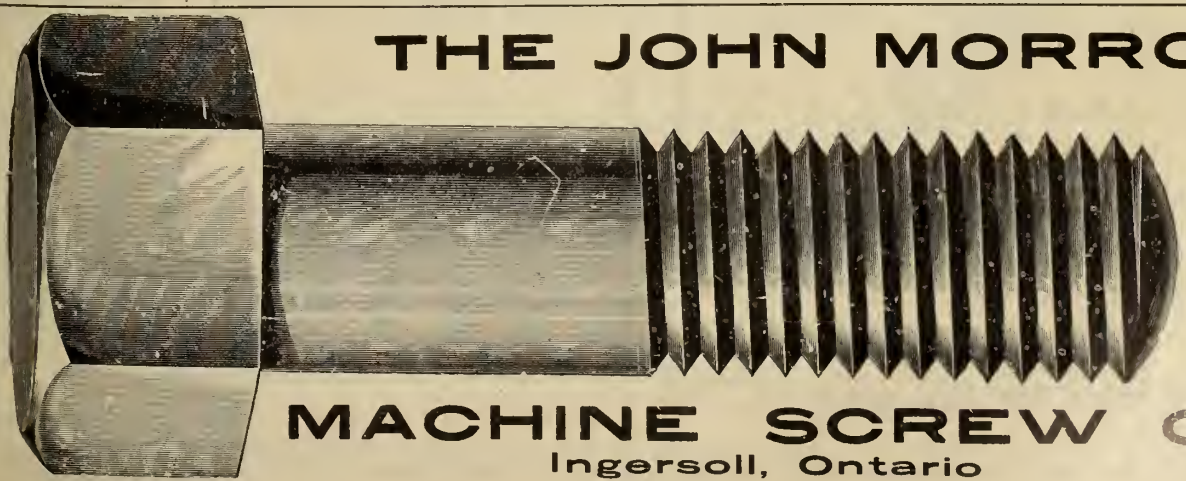

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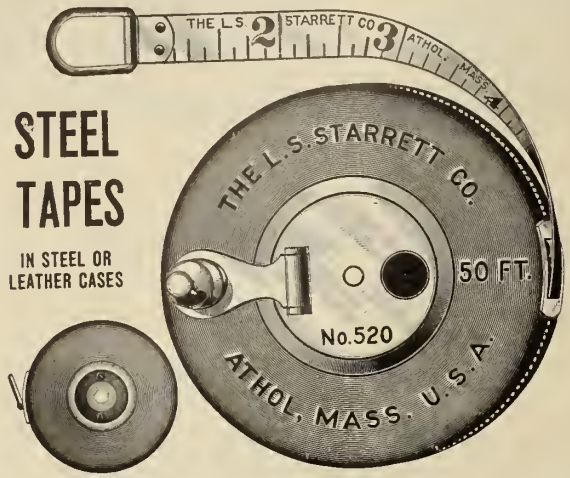

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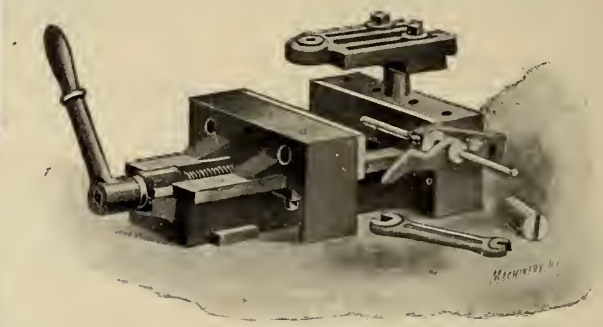

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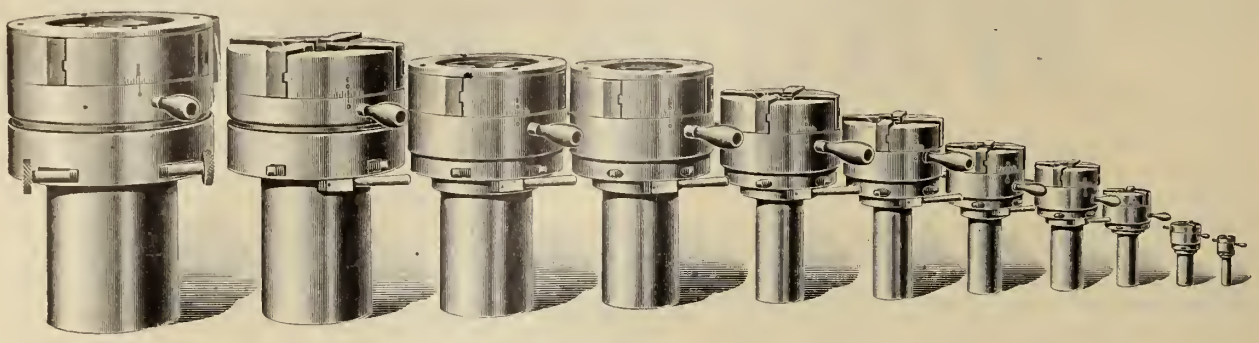

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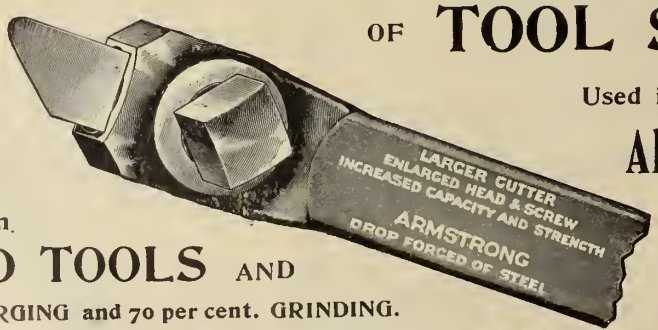

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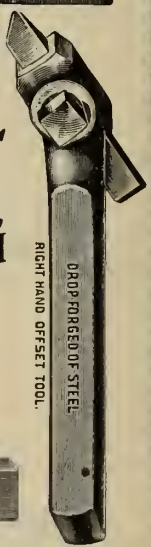

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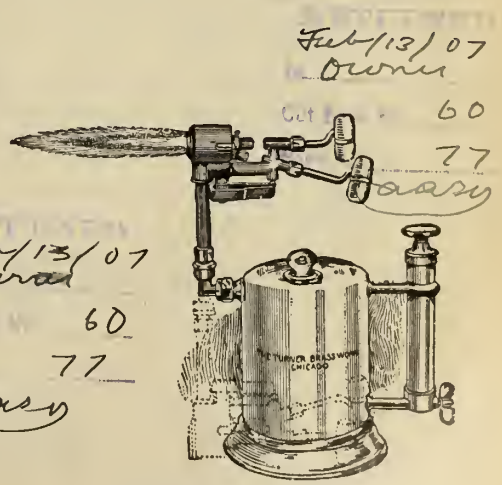

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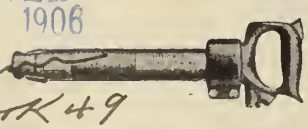

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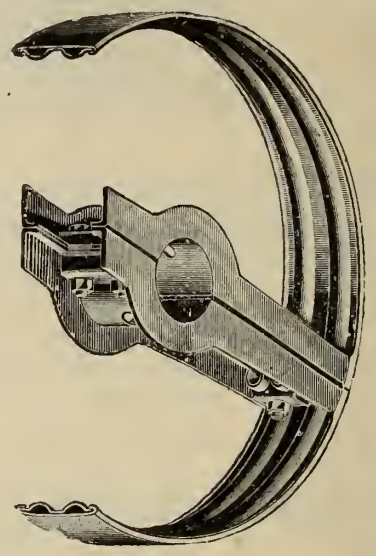

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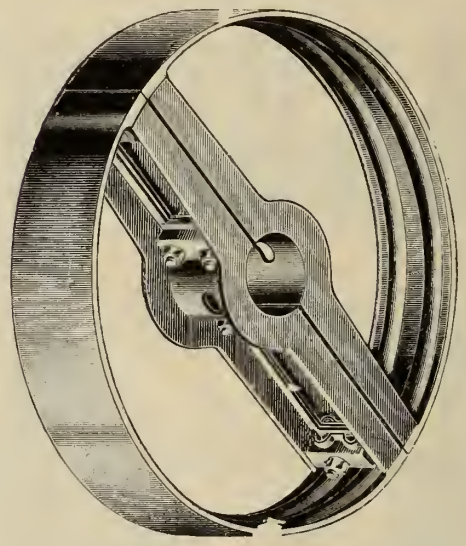

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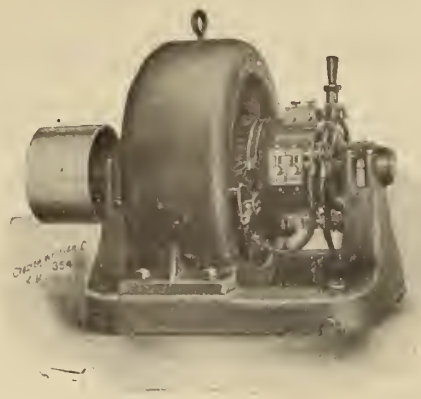

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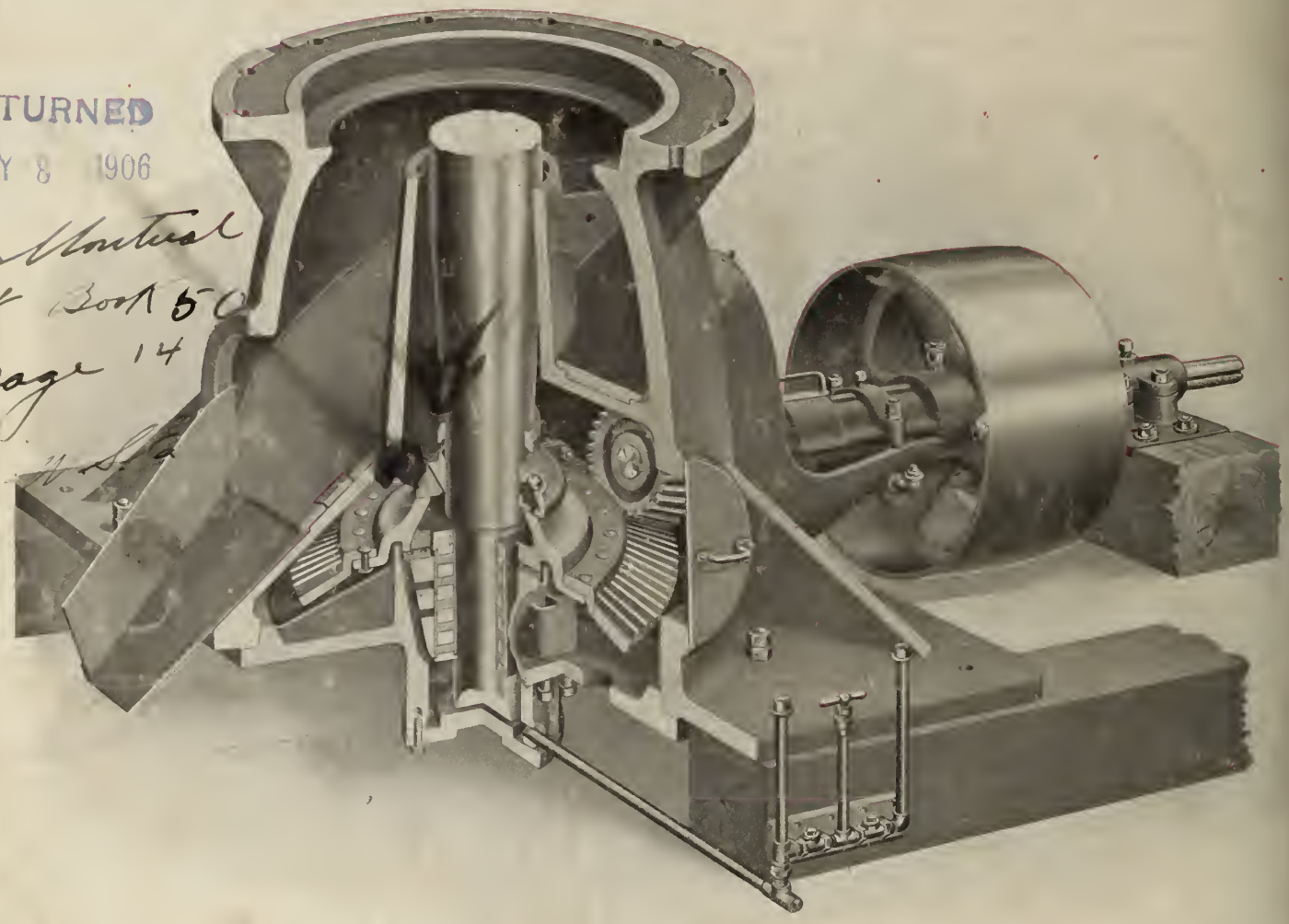

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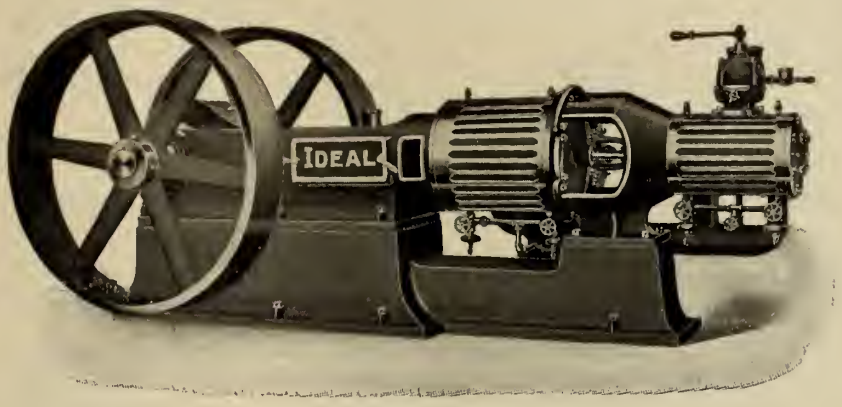

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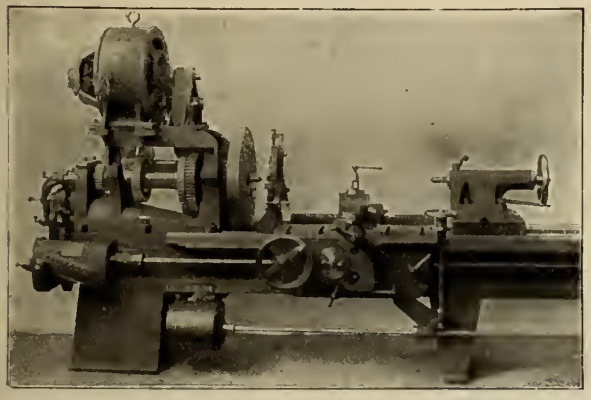

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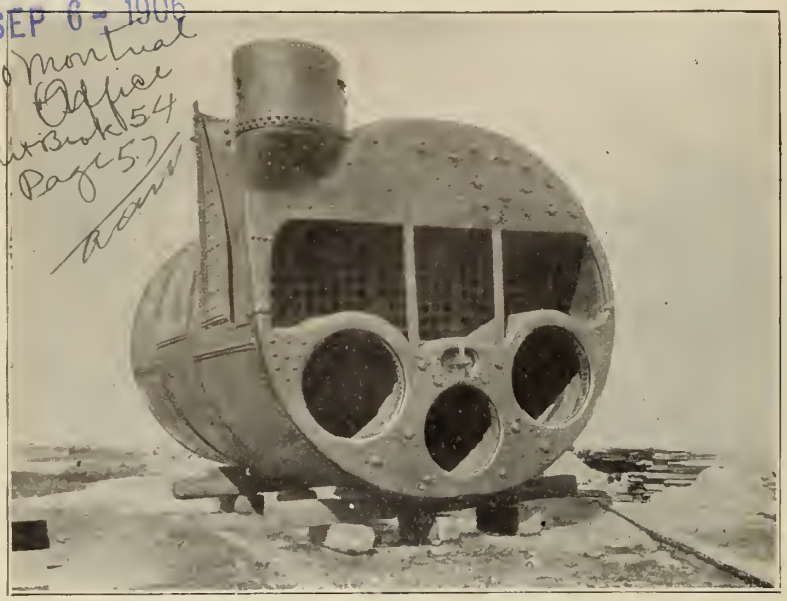

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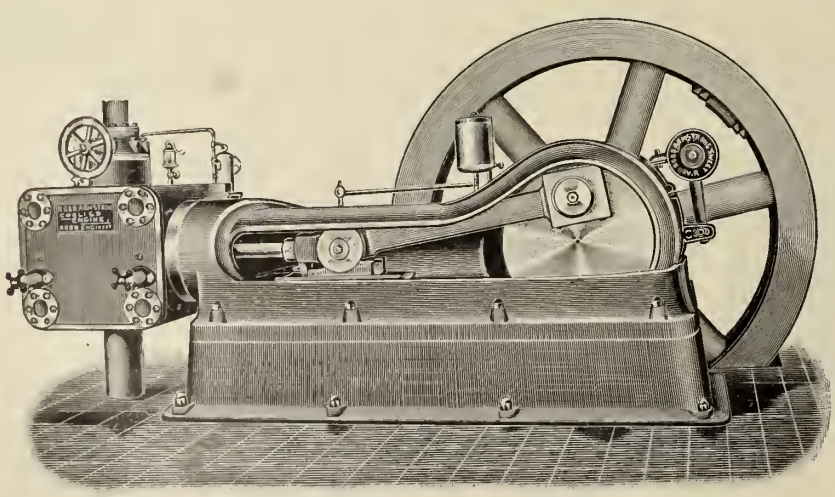

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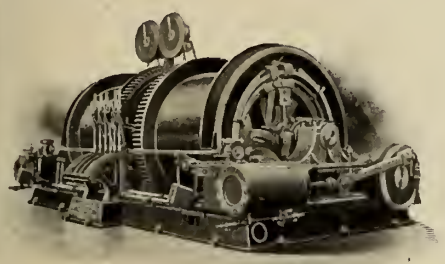

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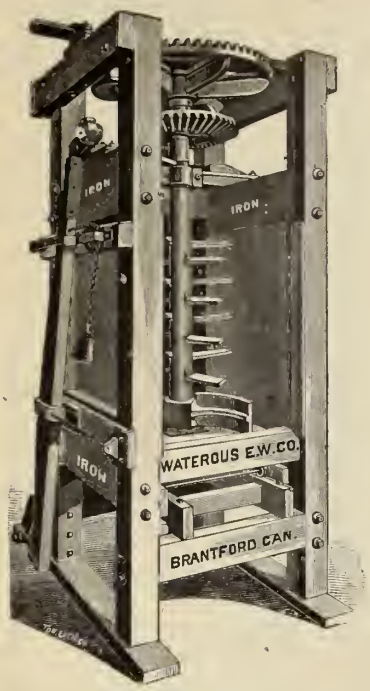

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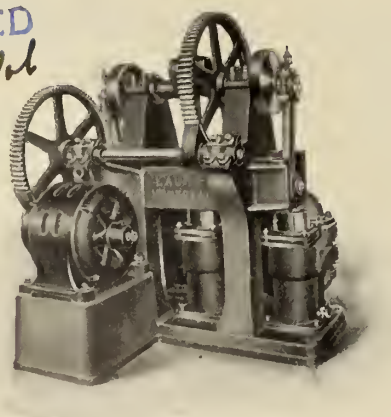

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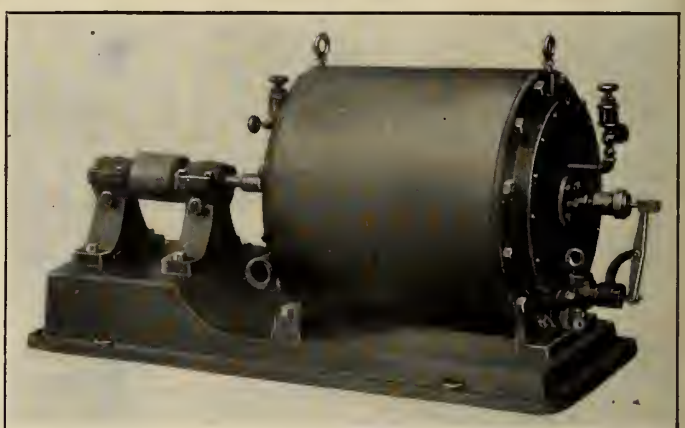

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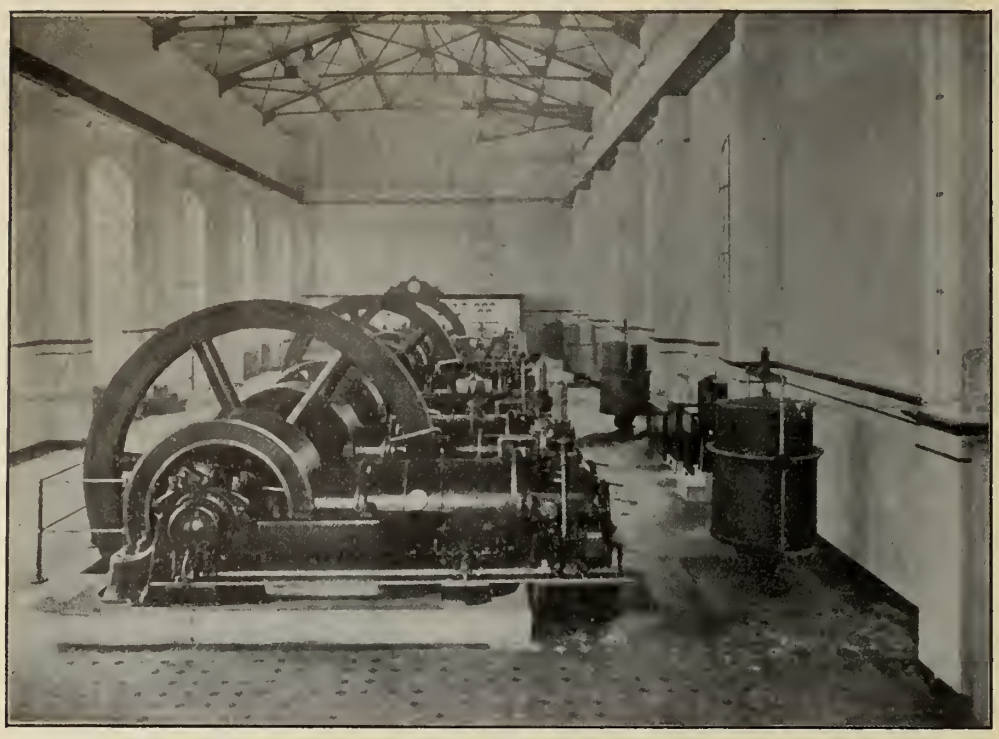

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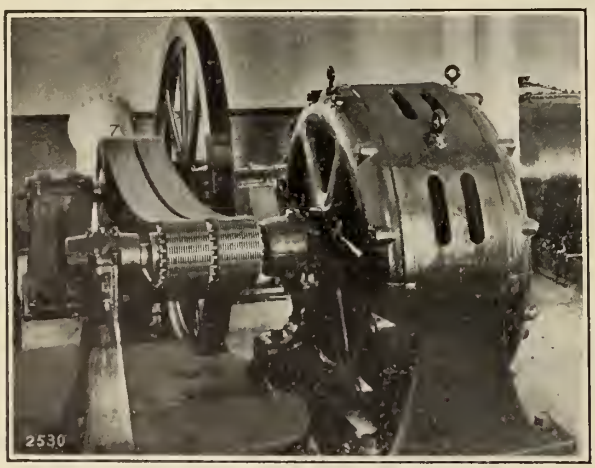

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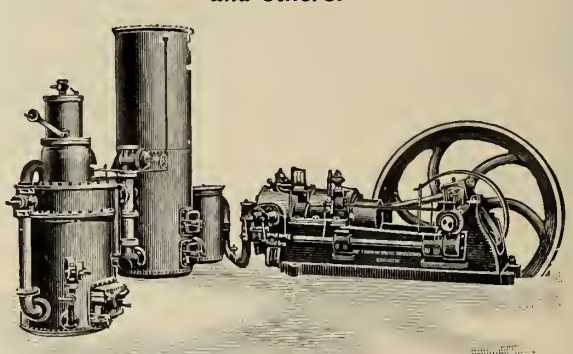

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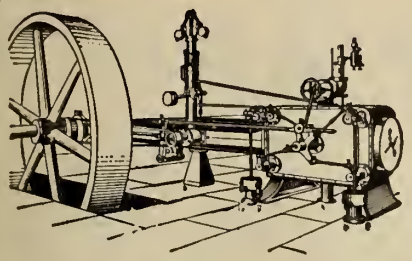

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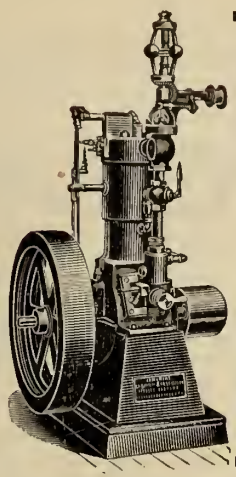

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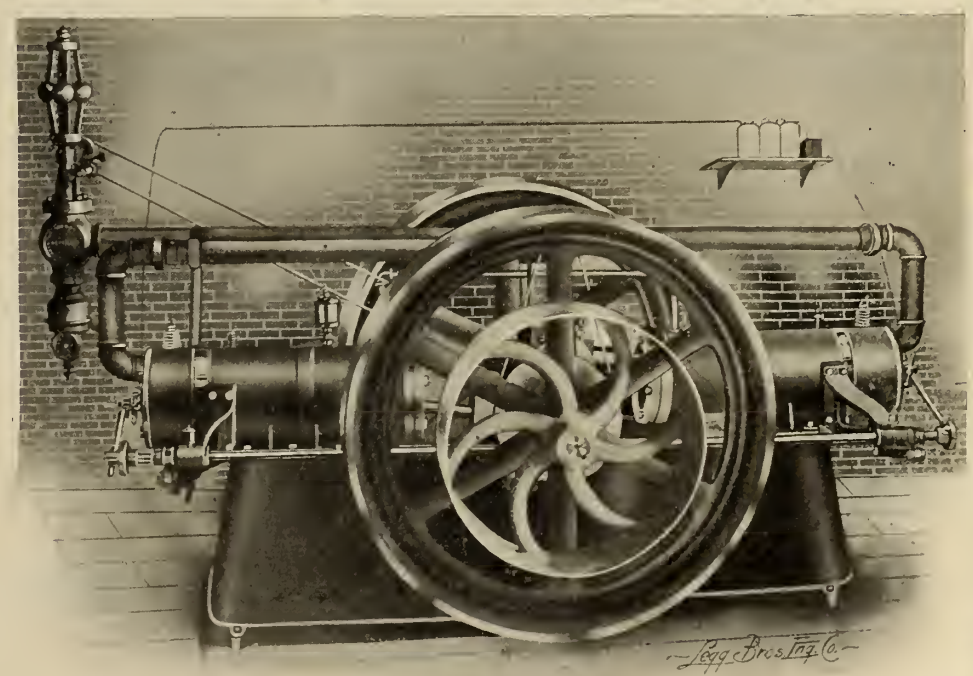

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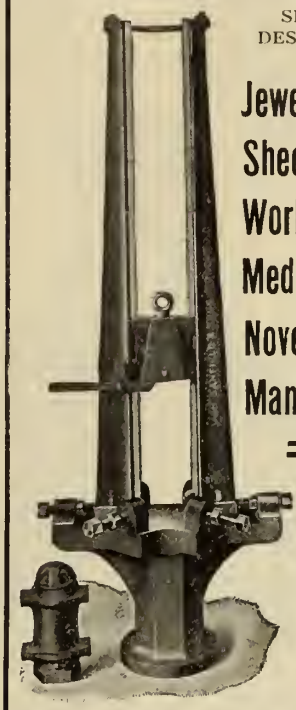

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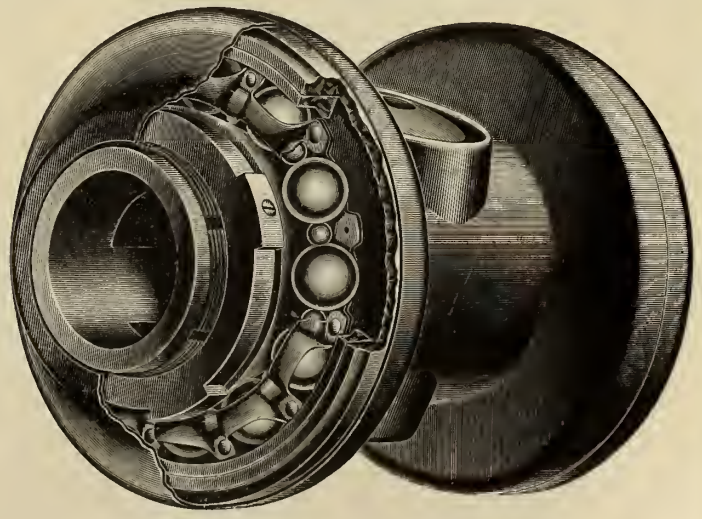

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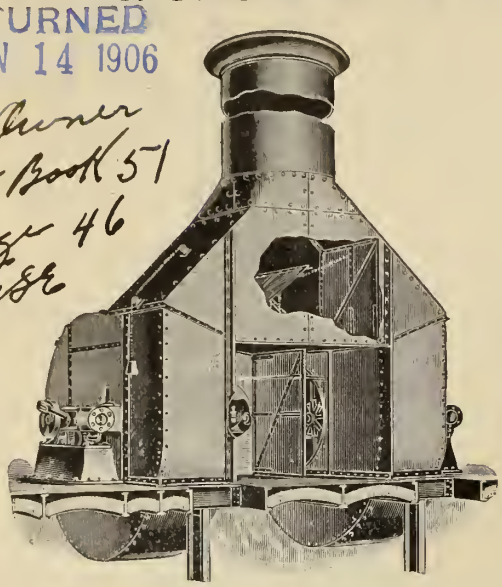

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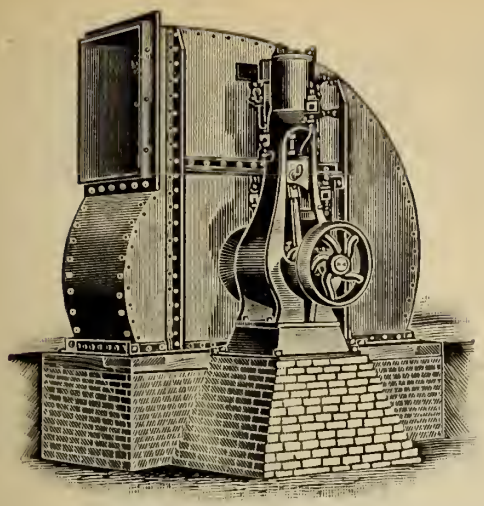
Designers and Builders of Heating, Ventilating, Drying and Mechanical Draft Apparatus ; Fans, Blowers and Exhausters ; Steam Engines, Electric Motors and Generating Sets ; Fuel Economizers ; Forges, Exhaust Heads, Steam Traps, Etc. 574



HEATING AND VENTILATING

HOT BLAST HEATING SYSTEMS for BUILDINGS of ALL SIZES.

PATENT STEAM HEATERS that give FULLY 25% MORE EFFICIENCY than others in the market.

PLANING MILL EXHAUSTERS and DUST SEPARATORS of IMPROVED PATTERNS.

Drying Systems for material of every description.

BLAST SYSTEM OR OTHERWISE.

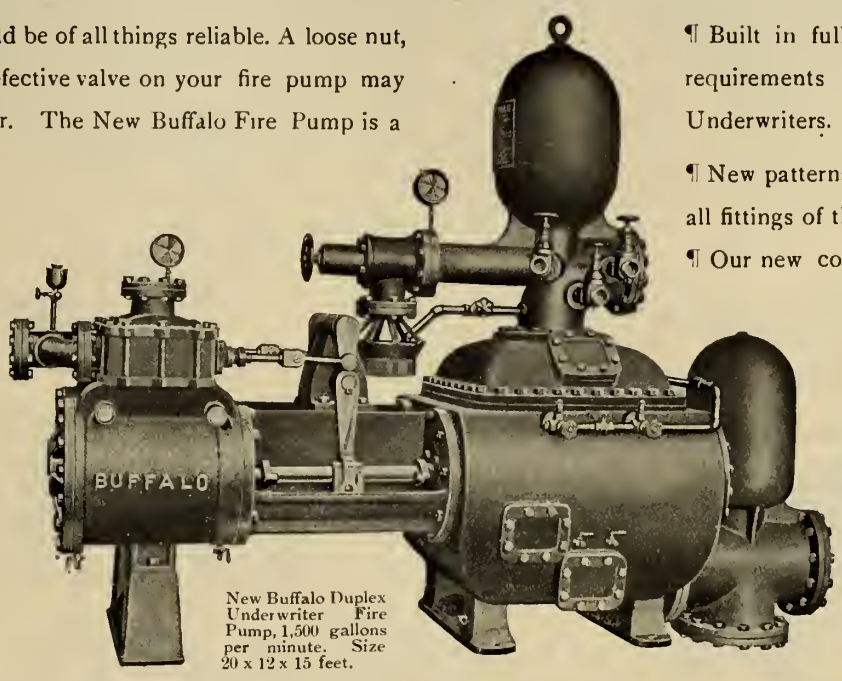
Fans and Blowers for all purposes.

For illustrated catalogue and particulars address

McEachren Heating and Ventilating Co., - Galt, Ont.

FIRE PROTECTION—BUFFALO UNDERWRITER PUMP

¶ Fire protection should be of all things reliable. A loose nut, sticking piston or a defective valve on your fire pump may some day spell disaster. The New Buffalo Fire Pump is a study in reliability. Its use is a guarantee of effectiveness at any and all times.



New Buffalo Duplex Underwriter Fire Pump, 1,500 gallons per minute. Size 20 x 12 x 15 feet.

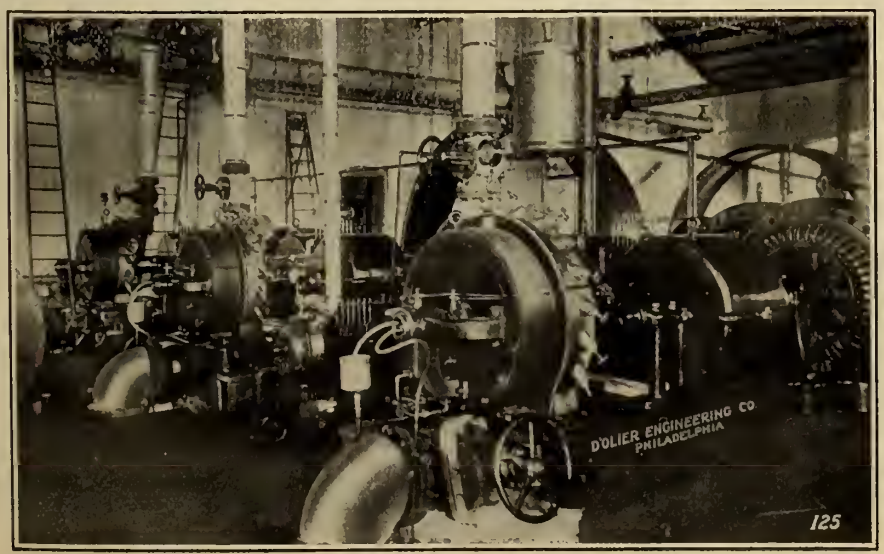
¶ Built in full conformity with the requirements of the Factory Fire Underwriters.

¶ New patterns used throughout and all fittings of the highest class.

¶ Our new complete catalogue will soon be ready for distribution. Let us add your name to the list.

Buffalo pumps, both reciprocating and centrifugal, are built in a complete line of sizes, from boiler feed to waterworks service. They are newly designed and conservatively rated and embody only such features as have been fully approved by years of service.

CANADIAN BUFFALO FORGE CO., Limited, MONTREAL, QUE.



3-200 KW DeLaval Steam Turbine Alternatorsinstalled at Jacksonville, Fla., U.S.A., Municipal Plant.

DE LAVAL STEAM TURBINE MACHINERY

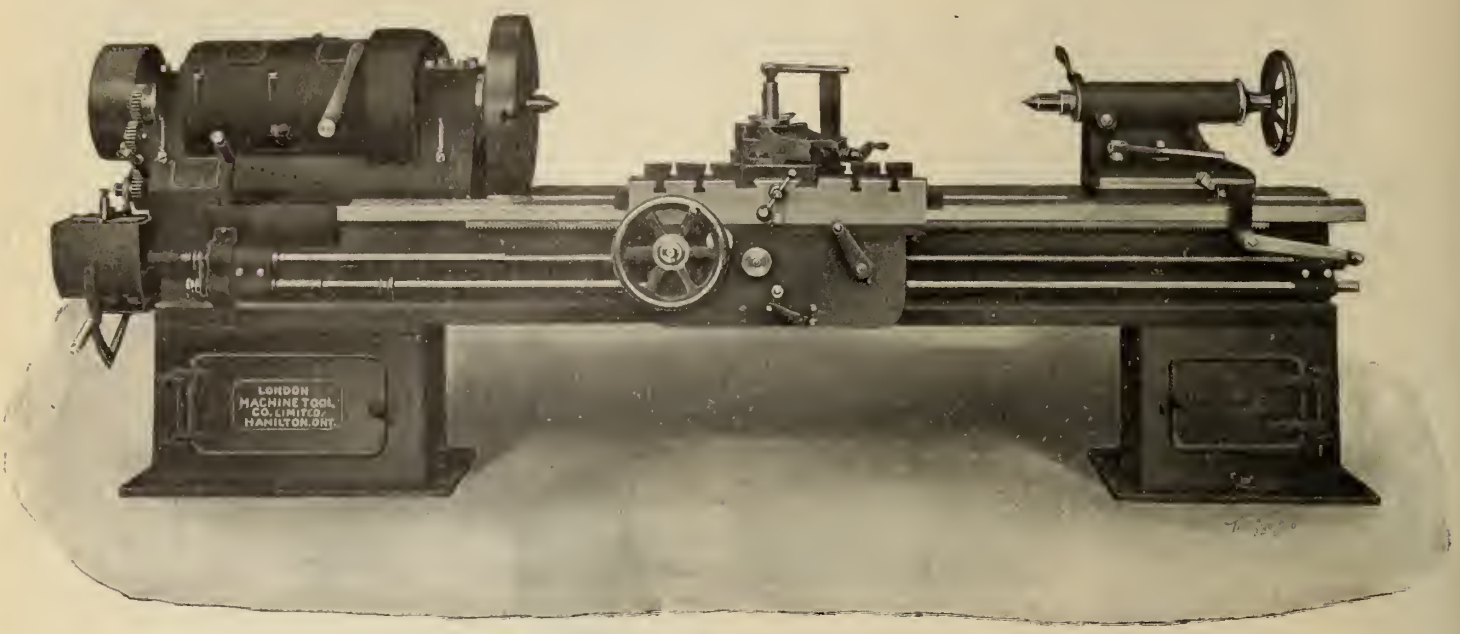
Turbine Motors
Turbine Dynamos
Turbine Pumps

Highest Efficiency. *Long Life.*

D'Olier Engineering Co.

74 CORTLANDT STREET, NEW YORK, U.S.A.

LONDON MACHINE TOOL CO., LTD.



New Type, 22 in. All Geared Lathe.

HAMILTON, - ONTARIO

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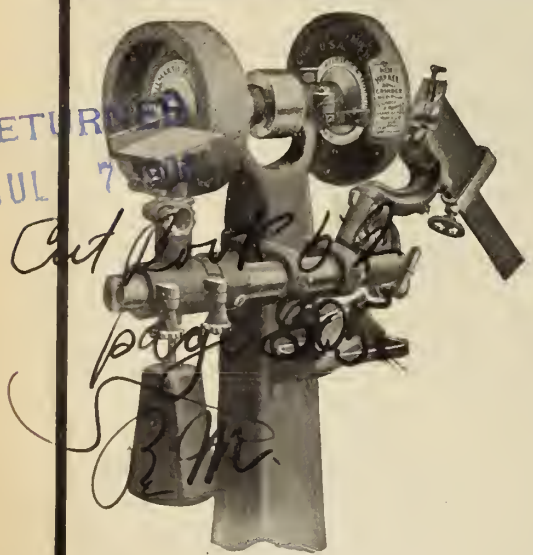
page 80



NO!

It does not cost more to grind Drills right.

IT COSTS LESS!

The first cost of a ***New Yankee Drill Grinder*** is low, and the moment you get it set up it commences to make the grinding of drills cheaper (for this can be done ***right*** on our machine cheaper than ***wrong***, by hand) and every one of these drills do a whole lot more work, as well as do it quicker and better.

We're constantly shipping machines into Canada and would like to put you in touch with our agents there.

WILMARTH & MORMAN CO.
577 Canal Street, - Grand Rapids, Mich.

"BLISS"

COMPLETE DROP FORGING PLANTS

We have in our employ men experienced in this class of work and are prepared to fit out complete Drop Forging Plants with the most up-to-date machinery for every department, including Drop Hammers, Dies, Trimming Presses, Furnaces, Blowers, etc.

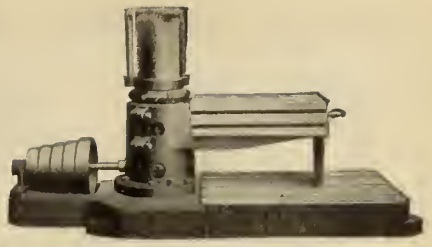
Quality unexcelled.
Write for prices and full particulars.

E. W. BLISS CO., 20 Adams Street BROOKLYN, N. Y., U. S. A.

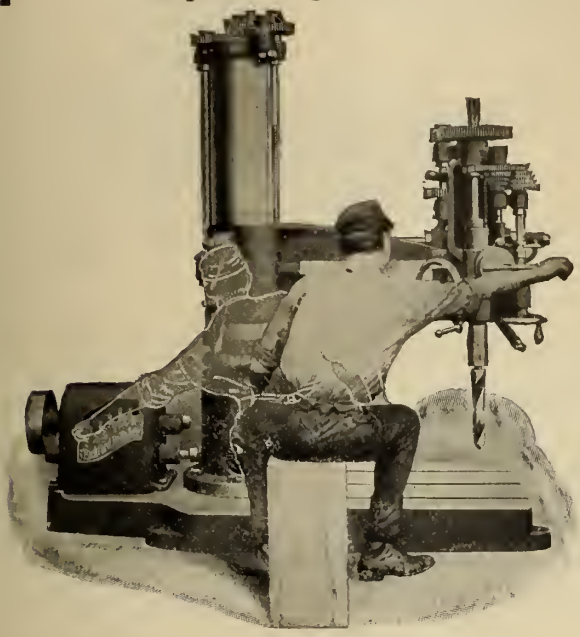
EUROPEAN OFFICE—Clichy pres Paris, France. Distributing Agents for Chicago and vicinity—Stiles-Morse Co., 65 W. Washington St., Chicago, I l.

Has Greater Productive Capacity

than any Upright ever built—our 30-in. RADIAL DRILL. Costs but a trifle more and is admirably adapted to light and medium manufacturing, being particularly effective in taking care of the ordinary work as found in the average shop.



Cone Drive and Swinging Table



Bickford 30"-36"-42" Radial Drill

A Few Features

12 speeds when driven through a speed box ; 10 when a cone is used.

Tapping attachment incorporated in the design of the head.

Fitted with any one of six styles of tables.

Circular 1-A for the asking.

The Bickford Drill & Tool Company

Cincinnati, Ohio, U.S.A.

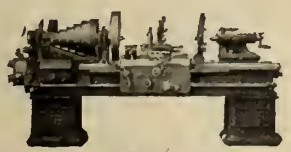
FOREIGN AGENTS—Schuchardt & Schutte, Berlin Vienna, Stockholm, St. Petersburg, New York. Alfred H. Schutte, Cologne, Brussels, Liege, Paris, Milan, Bilbao, New York. Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow.

CANADIAN AGENTS—H. W. Petrie, Toronto. Williams & Wilson, Montreal

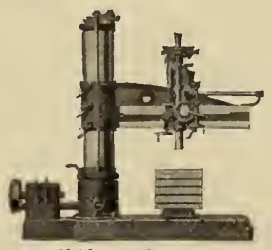
MODERN MACHINE TOOLS

WITH BELT OR MOTOR DRIVE

POWERFUL

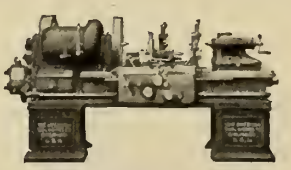


14 in. to 62 in. Swing.
With "Quick Change Gear Mechanism."



2½ ft. to 7 ft. Arm.
Driven through Speed Box or Cone.

ACCURATE



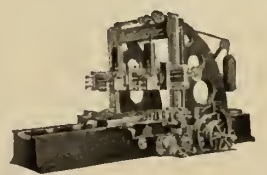
14 in. to 62 in. Swing.
"Patented" Geared Head (Single Pulley Drive.)

20 in. to 24 in. Swing.
Strong and Accurate.

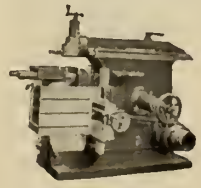
Write direct, or to

H. W. PETRIE, MONTREAL

A. R. WILLIAMS MACH'Y CO., TORONTO



22 in. to 72 in. between Housings.
Single or Variable Speed.



16 in. to 28 in. Stroke.
Highly Geared.

25 in. to 36 in. Swing.
With Geared Feed.

THE AMERICAN TOOL WORKS CO.,

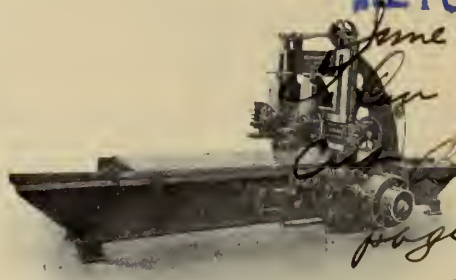
Cincinnati, U.S.A.

PLANERS

We like to talk about the machines we make simply because we like a good thing.

NOW LISTEN TO THIS:

"Please make us another machine exactly the same as one supplied last year."



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This from the best Machine Shop in Canada is sweet music.

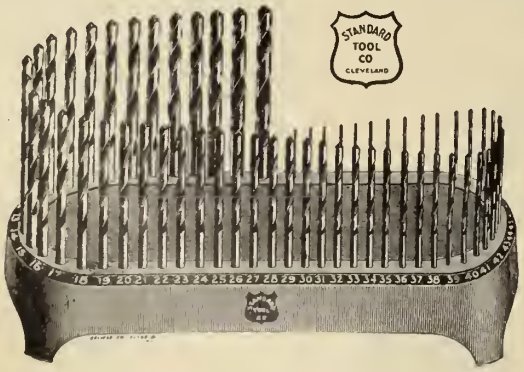
We wish we could know when you are in the market for a Planer, Lathe or Pipe Threading Machine, and we think we could interest you.

With us, quality first and with as little money as we can get along with.

THE R. McDOUGALL CO., Limited

GALT ONTARIO CANADA

Metal Drill Holder and Gauge Combined



A saving in time and tools. Neat and convenient. Does not become worn in service. Two kinds, for Jobbers and Wire Gauge Drills.

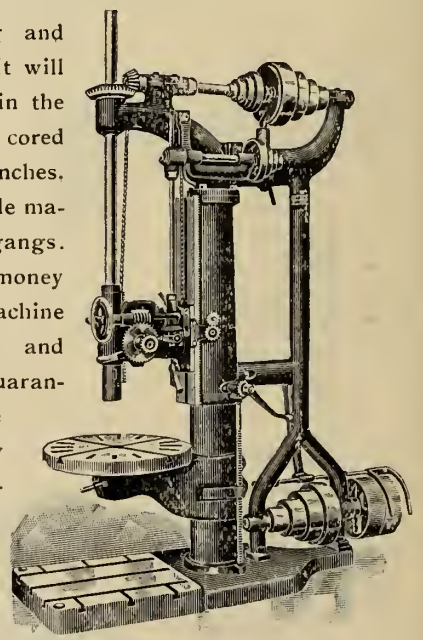
THE STANDARD TOOL CO.

Office and Factory
Cleveland, Ohio

Eastern Salesroom
94 Reade St., N.Y.

OUR 31-INCH SLIDING HEAD DRILL

is a very strong and powerful tool. It will drill 3-inch holes in the solid, or bore out cored holes up to 6 inches. Furnished in single machines or in gangs. This Drill is a money maker in any machine shop. Material and workmanship guaranteed. It will give you satisfactory and accurate service.



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Carried in stock by our Ontario Agent

H. W. PETRIE, TORONTO.

B. F. BARNES CO.
Rockford, Ill.

H. W. PETRIE *Offers the following -- selected from his present stock of*

NEW AND SECOND HAND MACHINERY

WATCH FOR CHANGES IN EACH ISSUE

Wood Planers
3′′ Heavy Smoothing Planer.
27′′ Cowan Double Surfacer
26′′ Mo. G. G. ′′ ′′
24′′ ′′ ′′ ′′
NEW 24′′ x 9′′ Surface Planer
24′′ Surface Planer, rebuilt
24′′ Pony ′′ ′′
22′′ Surface ′′ ′′
20′′ ′′ ′′ Gourlay
NEW 16′′ x 9′′ Surface Planer
′′ 12′′ Pony Planer
′′ 24′′ "Handy" Planer and Matcher
24′′ rebuilt ′′ ′′ ′′
24′′ Double Surfacer and Matcher
NEW 13′′ x 7′′ Lightning Planer and Matcher
13′′ Fast-feed Flooring Machine

Buzz Planers
3 NEW 12′′ Pedestal
1 12′′ rebuilt
1 10′′ ′′
1 6′′ ′′
58′′ Stroke Jointer

Wood Moulders
6′′ Four side American
8′′ 3 Side Cowan
7′′ 3 ′′ all rebuilt
8′′ 3 ′′ Cant, Gourlay
8′′ Sash Sticker
6′′ Sash Sticker

Saw Tables
2 NEW No. 1 Clement, Variety
4 ′′ Variety Tables
Dimension Saw Table
No 3 S. F. Rip Saw, Ballantyne
Egan Double Cut-off Saw
NEW Champion Cut-off Saw
Cowan Railway
4 Wood Frame Machines
2 NEW Swing Saws
2 Rebuilt ′′ ′′

Band Saws
2 NEW 36′′ Pedestal
36′′ Pedestal in good order
NEW 32′′ Pedestal
′′ 30′′ Bracket
30′′ Bracket, rebuilt
NEW 26′′ Pedestal

Re-Saws
Rebuilt Band Re-Saw, 54′′
40′′ Galt Circular Re-Saw
36′′ ′′ ′′ ′′
Rogers Vertical

Other Wood-Working Machines
2 NEW Heavy Shapers
3 Rebuilt Shapers
Galt Power Mortiser
NEW Foot Power Mortiser
Rebuilt ′′ ′′ ′′
4 Tenoning Machines
2 Dowel Machines, 1½′′ and 2½′′
3 Dovetailing Machines
36′′ Double Drum Egan Sander
3 Box-Nailing Machines
7 Blind Slat Tenooners.
Borers and Wirers
NEW Lath Mill, 4 saws
Waymouth Gauge Lathe
18′′ Wood Lathe
Wood Trimmers, all sizes
5 Self-acting Shingle Machines
Swing Shingle Machines
Shingle Jointers and Packers

Saw Mill Machinery
2 NEW 3 Block Mills
3 Rebuilt Mills
NEW No. 4 Tower Double Edger
′′ Tower Trimmer
No. 1 Gang Edger, 3-18′′ Saws
NEW Wood Frame Drag Saw

Water Wheels
2′′ Right Hand Leffel
2½′′ ′′ ′′ Farrens
2½′′ Left ′′ Leffel
3′′ ′′ ′′ Perfection
Water Wheel Governor

Horizontal Boilers
66′′ x 14′ a'most new
60′′ x 17′ 6′′ with 54 4′′ tubes
6′′ x 13′ 7′′ ′′ 84 3′′ ′′
56′′ x 14′ 4′′ ′′ 64 3′′ ′′
60′′ x 12′ ′′ 82 3′′ ′′ NEW
54′′ x 12′ ′′ 62 3′′ ′′
48′′ x 16′ ′′ 33 4′′ ′′
48′′ x 16′ 6′′ ′′ 52 3′′ ′′

HORIZONTAL BOILERS—(Continued)
48′′ x 13′ 6′′ with 42 3′′ tubes
44′′ x 13′ 6′′ ′′ 43 3′′ ′′
44′′ x 14′ 6′′ ′′ 40 3′′ ′′
44′′ x 11′ 9′′ ′′ 42 3′′ ′′
40′′ x 12′ ′′ 21 3′′ ′′
38′′ x 12′ ′′ 36 3′′ ′′
32′′ x 11′ ′′ 22 3′′ ′′

Upright Boilers
48′′ x 10′ 6′′ with 152 2′′ tubes
36′′ x 72′ ′′ 60 2′′ ′′
26′′ x 60′′ ′′ 37 2′′ ′′
25′′ x 48′′ ′′ 37 2′′ ′′
24′′ x 50′′ ′′ 31 2′′ ′′
20′′ x 40′′ ′′ 41 2′′ ′′
20′′ x 36′′ ′′ 16 2′′ ′′ NEW
19′′ x 44′′ ′′ 13 2′′ ′′ NEW
19′′ x 40′′ ′′ 9 2′′ ′′ NEW

Automatic Engines
15′′ x 34′′ Left hand Wheelock
13′′ x 30′′ Right hand Corliss
11′′ x 24′′ Left hand Corliss
10′′ x 24′′ Right hand Corliss
12′′ x 10′′ Westinghouse Junor
12′′ and 20′′ x 12′′ Erie Ball Tandem compound
10′′ x 15′′ NEW No. 8 Jewel
8′′ x 10′′ ′′ 5 ′′
8′′ and 13′′ x 18′′ Tandem compound
6½ x 8′′ Armington & Sims
5′′ x 7′′ ′′ ′′

Other Steam Engines
Complete generating plant, consisting of 2 17′′ x 38′′ Wheelock Engines; 2 73′′ x 14′ Goldie & McCulloch Boilers; 2 8′′ x 12′′ x 12′′ Condensers, Pumps, Heaters, etc. Also 2 100 K.W., M.P.—4 Generators, Canad an General Electric Co. make. This plant was last used to run an Electric Railway line of 10 cars.
12′′ x 18′′ rebuilt horizontal
11′′ x 11′′ Leonard centre crank
10′′ x 15′′ Erie centre crank
10′′ x 16′′ rebuilt horizontal
12′′ x 12′′ Laurie, NEW, horizontal
8¾′′ x 9′′ horizontal
8′′ x 8′′ Laurie, NEW, horizontal
7′′ x 12′′ horizontal
7½′′ x 9′′ Dutton NEW, horizontal
7′′ x 7′′ NEW, upright
6′′ x 9′′ horizontal
6′′ x 7½′′ ′′ centre crank
6′′ x 8′′ upright
6′′ x 6′′ ′′ NEW
5′′ x 6′′ horizontal
5′′ x 7½′′ upright, centre crank
Also several small engines down to ¾ H.P., horizontal and upright.

Marine Engines
12′′ x 25′′ x 18′′ steeple compound
8′′ and 16′′ x 12′′ NEW, fore and aft
7′′ and 14′′ x 10′′
7½′′ and 14′′ x 12′′ steeple compound
5′′ x 10′′ x 6′′ fore and aft with shaft and wheel
3½′′ x 7′′ x 6′′ fore and aft, compound
14′′ x 14′′ with shaft and wheel
9′′ x 12′′ Doty
9′′ x 12′′ NEW, complete
8′′ x 8′′ ′′
7½′′ x 8′′ ′′ Dutton
6′′ x 6′′ all complete
5′′ x 7½′′ ′′
Also several smaller ones.

Miscellaneous Engines and Boilers
30 H.P. Horizontal Self-Cont. Boiler.
60 H.P. Fire Box Boiler
50 H.P. ′′ ′′
25 H.P. ′′ ′′
16 H P. Waterous Portable Boiler
5′′ x 16′′ New Portable on wheels
7′′ x 10′′ Cornell ′′ ′′
74′′ x 11′′ Clyde Boiler
48′′ x 72′′ Fitzgibbon Boiler
48′′ x 72′′ upright submerged tube Boiler
4 H P. Acme Engine and Boiler

Cas or Casoline Engines
One 50 H.P. New Ohio
One 21 H.P New Ohio
One 15 H P. Pierce
Two 14 H.P. New Ohio
One 14 H P. Ohio on wheels
One 12 H P. Brantford
Two 10 H.P. Haggas
Three 8 H.P. Ohio, NEW
Two 6 H.P. Ohio
One 6 H.P. Toronto Junction

GAS OR GASOLINE ENGINES—(Continued)
Two 4 H. P. New Ohio
One 3½ H.P Triton-Marine
Two 3 H. P. Upright
One 2½ H. P. Goldie & McCulloch
Four 1½ H. P. NEW and Second-Hand

Pumps
1 12′′ x 7′′ x 12′′ Northey Duplex
3 8′′ x 5′′ x 12′′ NEW Duplex
5 5′′ x 4′′ x 7′′ ′′ ′′
6 5½′′ x 3½′′ x 6′′ ′′ ′′
18 4½′′ x 2¾′′ x 4′′ ′′ ′′
8 3′′ x 2′′ x 3′′ ′′ ′′
8′′ x 5′′ x 12′′ Single Acting
7′′ x 4′′ x 6′′ ′′ ′′
6½′′ x 4½ x 7′′ ′′ ′′
6′′ x 4′′ x 6′′ ′′ ′′
5′′ x 3½′′ x 7′′ ′′ ′′
Several Small ′′ ′′
NEW Morris Centrifugal, Nos. 2 and 4
NEW Taber Rotary, Nos. 0, 1 and 2
3¾′′ x 8′′ pedestal plunger pump
3′′ x 5′′ ′′ ′′ ′′
2′′ x 6′′ ′′ ′′ ′′
Several small plunger pumps

Steam Appliances
NEW Pulsometers, Nos. 4 to 7
8 Steam Traps, all sizes
150 H.P. Goldie, McC. Heater
50 ′′ NEW Laurie ′′
30 ′′ ′′ ′′ ′′
40 ′′ ′′ Patterson ′′
30 ′′ National 3′′ Exhaust
30′′ x 96′′ Heater
16′′ x 50′′ ′′
18′′ x 33′′ ′′

Engine Lathes
1 NEW 32′′ x 20′ London
1 ′′ 32′′ x 18′ ′′
1 30′′ x 14′′ heavy bed
1 NEW 28′′ x 18′ London
1 28′′ x 18′ Dundas
1 NEW 26′′ x 16′, also 10′ bed
5 ′′ 25′′, 10′, 12′ and 14′ bed
8 ′′ 24′′, from 10′ to 20 ft.
4 ′′ 21′′, 8′, 10′ and 12′ bed
10 ′′ 18′′, 6′ to 16 ft.
1 24′′ x 8′ Dundas
1 18′′ x 6′ in good order
11 NEW 16′′ from 6′ to 10 ft.
2 16′′ x 6′ rebuilt
10 NEW 15′′ from 6′ to 10 ft.
4 ′′ 14′′ 6 and 8 ft.
3 ′′ 13′′ 6 ′′ 8 ft.
1 14′′ x 6′ Dundas
3 NEW 12′′ x 6 ft
1 ′′ 14′′ x 60′′ Barnes
1 ′′ 9′′ x 57′′ ′′

Cap and Other Lathes
28′′ x 40′′ x 12′ Gap, Dundas
NEW 26′′ x 42′′ x 14′ Gap
2 ′′ 24′′ x 40′′ x 12′ ′′
2 ′′ 24′′ x 40′′ x 10′ ′′
′′ 30′′ x 46′′ x 12′ ′′
′′ 18′′ x 32′′ x 12′ ′′
12′′ x 24′′ x 60′′ Dundas
22′′ x 8′ Chucking Lathe
18′′ x 8′ Davis Turret Lathe
16′′ x 6′ Fox Lathe
NEW 15′′ x 6′ Fox Lathe
11′′ x 48′ Speed Lathe
NEW 11′′ x 72′′ Barnes Foot Power
′′ 11′′ x 60′′ ′′ ′′ ′′
2 ′′ 9′′ x 45′′ ′′ ′′ ′′
No. 4½ Barnes ′′ ′′
9′ x 40′′ Cincinnati ′′ ′′

Iron Shapers
2 NEW 24′′ Back Geared Imperial
6 ′′ 20′′ ′′ ′′ ′′
20′′ rebuilt Ohio
1 NEW 16′′ Back Geared Cincinnati
1 ′′ 16′′ Single ′′ ′′
16′′ rebuilt, London
1 10′′ second-hand Ohio
1 7′′ ′′ ′′ Rhodes

Iron Planers
60′′ x 60′′ x 11′ American, 2 heads
44′′ x 44′′ x 11′ ′′ ′′
42′′ x 42′′ x 20′ Putman
NEW 37′′ x 48′′ x 12′ London
′′ 36′′ x 41½′′ x 10′ ′′
30′′ x 30′′ x 8′ American
30′′ x 24′′ x 6½′ ′′
26′′ x 26′′ x 7′ ′′ 2 heads
2 26′′ x 26′′ x 7′ ′′
NEW 26′′ x 26′′ x 8′ Imperial

IRON PLANERS—(Continued)
4 NEW 24′′ x 24′′ x 6½′ Imperial
5 ′′ 20′′ x 20′′ x 5′ London
24′′ x 24′′ x 36′′ American
23′′ x 23′′ x 5′ ′′
23′′ x 20′′ 5½′ ′′
3 Small Hand Planers

Drilling Machines
NEW 42′′ Baush Boring Mill, with swivel and Turret heads
3 NEW 100′ Plain Radials
2 ′′ 72′′ Universal Radials
′′ Baush 6 Spindle Drill, with tapping attachment
1 6 Spindle Multiple
1 4 ′′ ′′
2 NEW 31′′ Barnes
1 ′′ 25′′ ′′
1 ′′ 24′′ Cincinnati, with tapping attachment
1 NEW 24′′ London
1 24′′ in good shape
7 NEW 20′′ Barnes, B. G.
3 ′′ 22′′ ′′ Lever Feed
2 ′′ 14′′ Sensitive, Pedestal
2 ′′ 14′′ ′′ Bench
2 11′′ Plain, Upright
1 NEW 12′′ Barnes Friction
2 ′′ 10′′ Friction
1 ′′ Fox High Speed Drill
6 Sensitive Bench Drills NEW
2 Post or Wall Drills
8 Blacksmiths' Hand Drills
6 ′′ ′′ and Power Drills

Presses and Hammers
5 No. 21 Power Press, NEW
4 ′′ 20 ′′ ′′ ′′
1 ′′ 18 ′′ ′′ ′′
3 ′′ 19 ′′ ′′ ′′
1 ′′ 16 ′′ ′′ ′′
No. 2 Cady Press
NEW No. 1 Challenge Soap Press
Power Draw Press
NEW Erie 400 lb. Steam Hammer
′′ 150 lb. Drop Hammer
2 ′′ 150 lb. Law Power Hammers
60 lb. Palmer Spring
NEW 50 lb. Foot Power
4½′′ x 10′′ Steam Hammer
Several smaller ones

Punches and Shears
1 NEW 2′′ throat, London
5 ′′ 15′′ ′′ ′′
14′′ throat, Bertram
NEW No. 5, Bremer, Single
′′ No. 4, ′′ Double
′′ No. 2, ′′ Single
′′ No 1, ′′ ′′
′′ No. 1, ′′ Double
Large Power Alligator Shear

Other Machine Tools
NEW No. 1 Cincinnati Plain Miller
30′′ x 6′′ x 16′′, Stevens Un. ′′
6 NEW Power Hack Saws
5 Iron Frame Keyseaters
NEW 2′′ Cutting-off Machine
′′ Centreing Machine
Large Hand Screw Press
2′′ Bolt Cutter and Threader
NEW 1½′′ National Bolt Cutter
′′ 1′′ Acme ′′ ′′
′′ 2′′ ′′ ′′
′′ 2′′ Bolt Cutter, with adjustable dies
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Several Bench and Pedestal Emery Grinders —all sizes
2 NEW 2½ Ton Portable Cranes
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New Cocoa and Chocolate Machinery
One Extra Sized Milanger
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One Patent Continuous Ruer
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One Gas Roaster capacity 60 lbs.
One Cocoa Sorting and Cleaning Machine
One Patent Hydraulic Cocoa Press
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Also the following:
Electric Motors and Dynamos
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Printers' Machinery
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Prices and details cheerfully given for the asking. Ask for a copy of my latest monthly Stock List.

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Underwood Portable Miller

The Special Portable Milling Machine

has just been brought out to suit your requirements.

May be taken to the work.

Carriage traverses 8 ft., Cross Side 12 in., and Vertical Spindle, 10 in.

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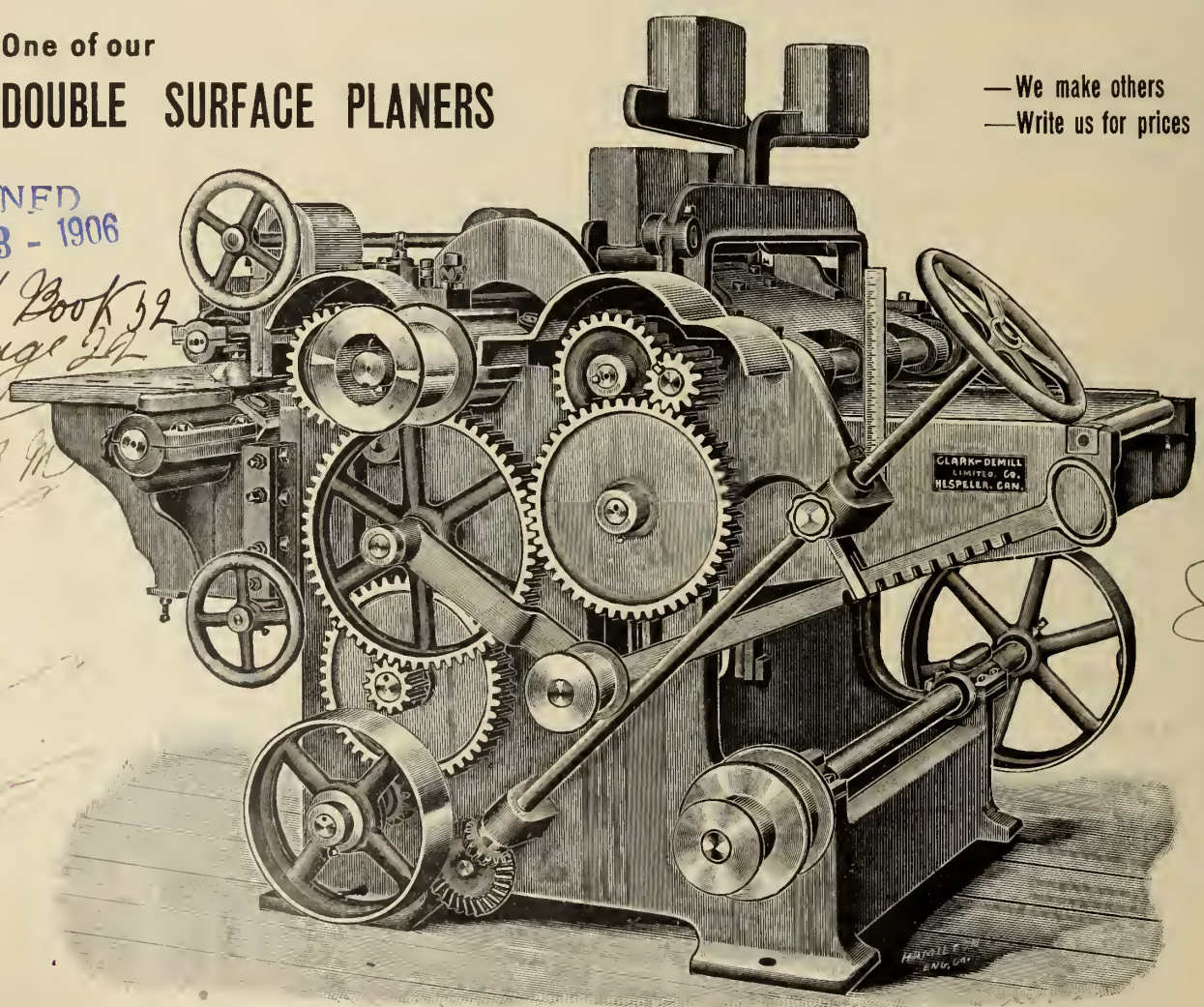

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Successors to **CLARK & DEMILL, of Galt, Ontario.**

Western Agents:—THE WATEROUS ENGINE WORKS CO., Limited, Winnipeg, Man.

No. 1-14 Cutter and Reamer Grinder.

WE HAVE A FEW OF THESE MACHINES READY FOR IMMEDIATE DELIVERY

This machine is distinctly a cutter grinder, and was designed to fill the want for a machine to sharpen milling cutters of all kinds and shapes, without special fixtures or special-shape emery wheels, being heavy enough to eliminate all vibration and still be easily operated. It weighs about 1370 lbs. The table, which has a long bearing on the saddle, has a longitudinal feed of 20 in., cross adjustment of 7 in., with a vertical adjustment of 6 in. Cutters 1 in. to 14 in. can be taken between centres. The table can be used at different angles with the spindle in horizontal plane, by swiveling the knee around the column. The machine is compact, durable, adaptable and a necessity for the busy shop.

Becker-Brainard Milling Machine Co.

HYDE PARK, MASS.

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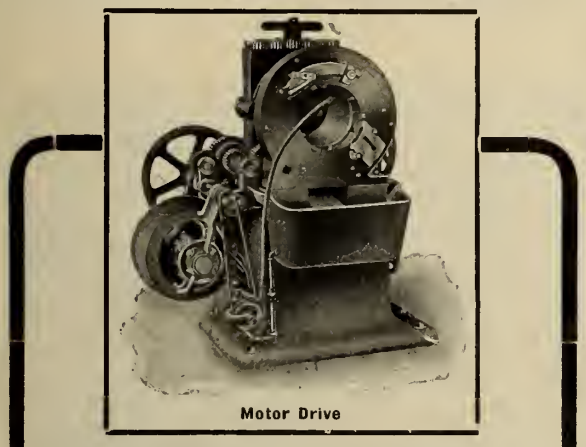

Motor Drive

If we can prove to you beyond doubt the superiority of

MERRELL PIPE THREADING AND CUTTING MACHINERY

you'd think it well worth while to be shown, wouldn't you?

If we can show you how these **MERRELL** combined Hand and Power Machines not only do more work, in a simpler, easier and neater manner—but do it better—do you think it might mean money for you to investigate further? Then do so now.

Our Catalogue Free.

This Combined Hand and Power Machine pictured above has our standard quick opening and closing die-head; self centering vise; improved cutting-off knife. Chasers may be released from threading while the machine is in motion. Can be used as a portable hand—or power driven machine. **Let us tell you more about it.**

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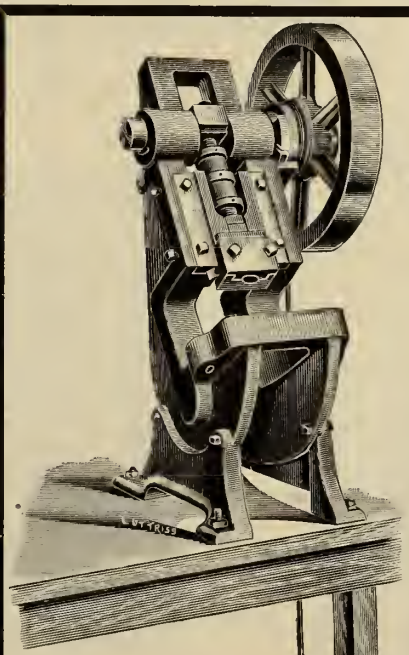

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ALL SIZES

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Equipped with instantaneous four-point clutch

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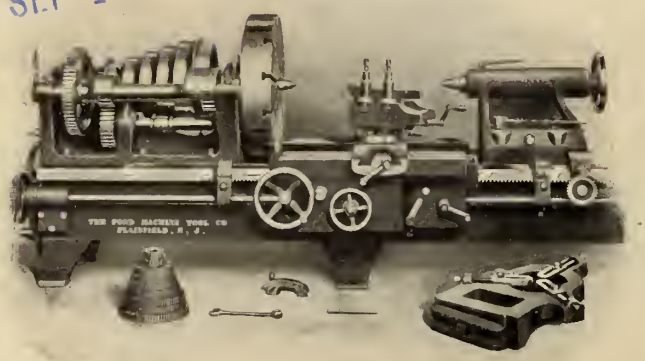

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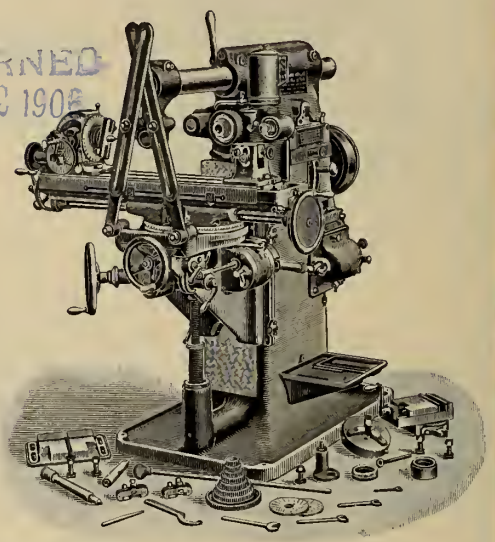

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The John Bertram & Sons Co., Limited, Brown & Sharpe,
E. W. Bliss Co., R. A. Kelly Co., Wilmarth & Morman,
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And other well known manufacturers

We have on hand a large and well assorted stock of Tools, and can deliver promptly.

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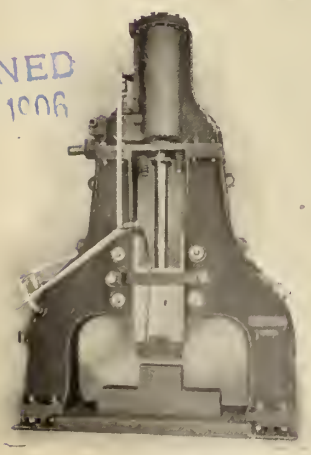

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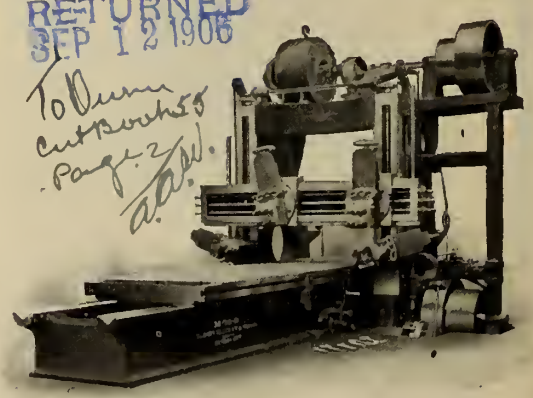

THE CANADIAN FAIRBANKS CO., LIMITED

Montreal Toronto Winnipeg Vancouver

Modern Canadian Manufacturing Plants.

ARTICLE XVI.—Plant of Polson Iron Works, Limited, Toronto.

LAST year saw Canada take a bound in the direction of industrial progress that caused some of the older inhabitants to wonder what it all meant. The more progressive, however, were fully conscious of the fact that it was undoubtedly an awakening in the minds of our own population and of other nations to the opportunities the country offered. Many firms came from across the border and established plants of their own to catch the growing business. Not a few Canadian firms grasped the situation and increased their capacity for production. To this latter class belong the Polson Iron Works, Limited, of Toronto, who have, during the past year, built an important addition to their already extensive plant, including a modern steel structure for ship building and a complete wood working department and store shed.

In 1886 this firm commenced business under its present management, although previous to that time the business had been carried on under the style of Wm. Polson & Co., at the foot of Jarvis street. When the present company commenced operations the cite chosen was the present location, and since then important additions have been made from time to time. The officers of the company are F. B. Polson, president and general manager; J. B. Miller, vice-president, the latter being also president of the Parry Sound Lumber Co.; A. H. Jeffrey, secretary, and W. B. Tindall, treasurer, while the following are superintendents of the different departments: W. E. Redway, superintendent of shipyards; J. J. Main, boiler shop department, and Alfred Duncan, machine shop, smith and pattern department.

Plant of Polson Iron Works.—West side of Shipbuilding Department.

Plant of Polson Iron Works.—Main Office.

General Scheme.

The property occupied by the firm comprises an entire block between Frederick and Sherbourne streets, south of the Esplanade and extends to the Windmill Line. In all it occupies about five acres, the reclamation of the major portion having been accomplished within the past three years. This gives a splendid water front and ample opportunities for shipbuilding, the water front being supplemented by two slips, one at the foot of each of the streets named. In all the firm has about 1,500 feet of docks and with 14 feet of water.

The present buildings are all new except the machine and boiler shops, which although not of modern structure, are equipped with the latest and best machinery to be had. The new buildings include a handsome office building two storeys in height, containing the general offices, accountant's and manager's offices on the ground floor, and the naval architect's, engineer's and drafting offices above. It is 80 x 32 feet, and, as may be seen from the illustration showing the accountant's office, is fitted up in most modern fashion.

Early last year work was commenced on the new shipbuilding structure, of unique design, as will be seen from the

RETURNED JUN 4 - 1906

drawing showing the general structure and which was soon completed and in full running order.

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JUN 4 - 1906

Plant of Polson Iron Works. General View from Harbor.

Different Departments.

Adjoining the office building is the blacksmith shop, equipped with a dozen forges, steam hammers and all the other tools necessary for a complete forging department. In the same building is situated the brass foundry and, further along, the power plant. The latter is equipped with two 250 H.P. Heine boilers for power and heating and here is also installed a complete air compressor plant for running the different pneumatic tools throughout the works. The other departments, which are situated in separate buildings from the one already mentioned, include the machine shop, boiler making plant, shipbuilding department and the woodworking and pattern making.

Machine Shop.

In the diagram shown, the general layout and position of the machine tools in the machine shop is given. A glance at this will show the grouping and arrangement as well as the different tools employed. These constitute a complement of machinery such as is necessary to meet the demands of a large plant. There are no particular or unusual points in connection with this machine shop apart from the fact that two of the machine tools are all exceptionally large size. One of these is an English planer 30 feet long, 12 feet wide, and 8 feet high, for the purpose of planing large bed plates of the different makes of engines turned out. Another noticeable machine is a boring mill manufactured by John Bertram & Sons, Dundas, which is designed for boring 18 foot diameter and 66 inch face. The machine shop looks after the machining of the engine parts as well as the repair and maintenance of the plant. The different engines manufactured are the Brown automatic stationary engine, the ordinary slide valve, marine engines of any size, compound and triple, as well as yacht engines of high speed.

RETURNED
JUN 4 - 1906

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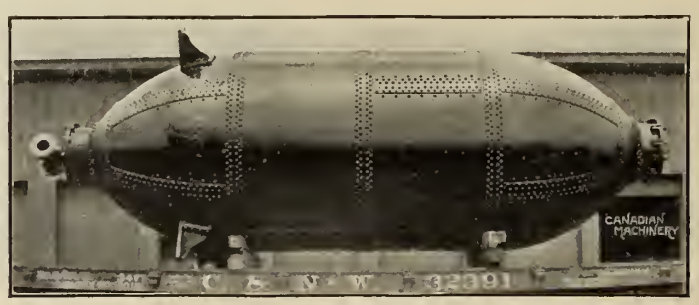
Plant of Polson Iron Works.—View in Shipbuilding Department, showing Heavy Rolls.

Boiler Department.

The boiler department adjoins the machine shop and is connected therewith by a car track which runs through the main departments and joins the main line of railway in front of the premises. This is one of the busiest departments of the entire works and in common with other boiler plants is accompanied by a din and uproar that is almost unbearable to the visitor, but which is looked upon with indifference by the workmen engaged. A large amount of the latest and best boiler making machinery is to be found here, putting the firm in a position to turn out not only a high-class product, but also to manufacture in large quantities. The machines include hydraulic and pneumatic riveters, heavy rolls, punches, steam and hydraulic flanging press and all necessary cranes for handling the material. The output here is quite varied and includes not only the ordinary Scotch boilers of all sizes and up to 200 pounds pressure, but the Heine water tube boiler as well as the Yarrow Mosher & Thornicroft Marshall water tube up to 300 pounds pressure. The illustration shows a large pulp digester made in this plant, its size being shown in relation to an ordinary flat railroad car. Contracts for these are at present on hand for mills in Hawkesbury and Cornwall. During the last year large oil tanks were constructed in this plant for Winnipeg and at present contracts are under execution for some very large steel tanks and malt hoppers for the Canada Malting plant in Winnipeg. Other lines made in this boiler works include air compressor tanks, air locks, and steel tunnels of every description. It is interesting to note in passing that during the past ten years over $600,000 worth of Heine boilers were made in this shop, the latter being but one of the many



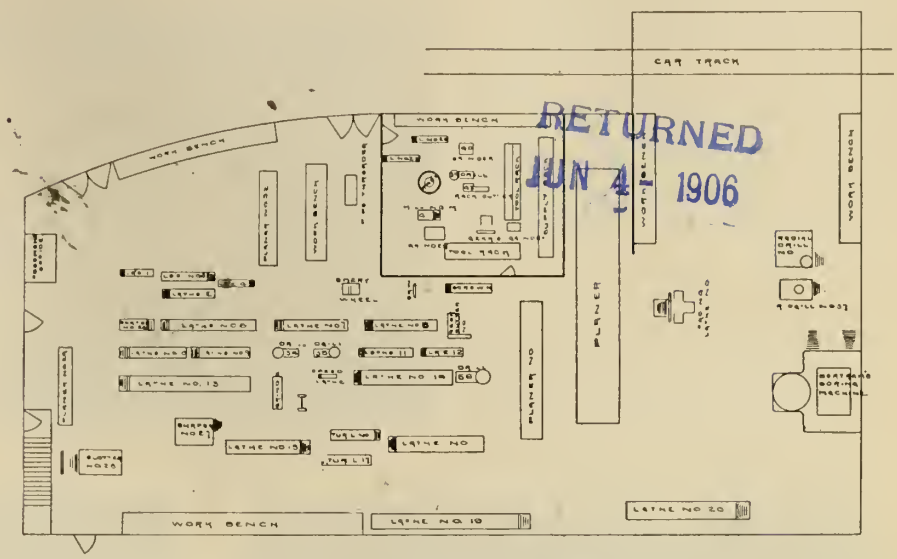
Wood Pulp Digester.

lines manufactured, and is under the personal supervision of Mr. J. J. Main.

Ship Building.

This is a branch of manufacture that has not received very much serious attention at the hands of Canadians, but has for some years been carried on to no small extent in the Polson Iron Works, where Mr. W. E. Redway devotes his attention to the peculiar problems confronting the designer of inland boats. The main features in the construction of ships are to be found in the handsome ship building plant already mentioned, which is 300 feet long, 80 feet wide and of two storeys, and an enormous traveling gantry with a span of 75 feet, a lift of five tons and a run of 400 feet.

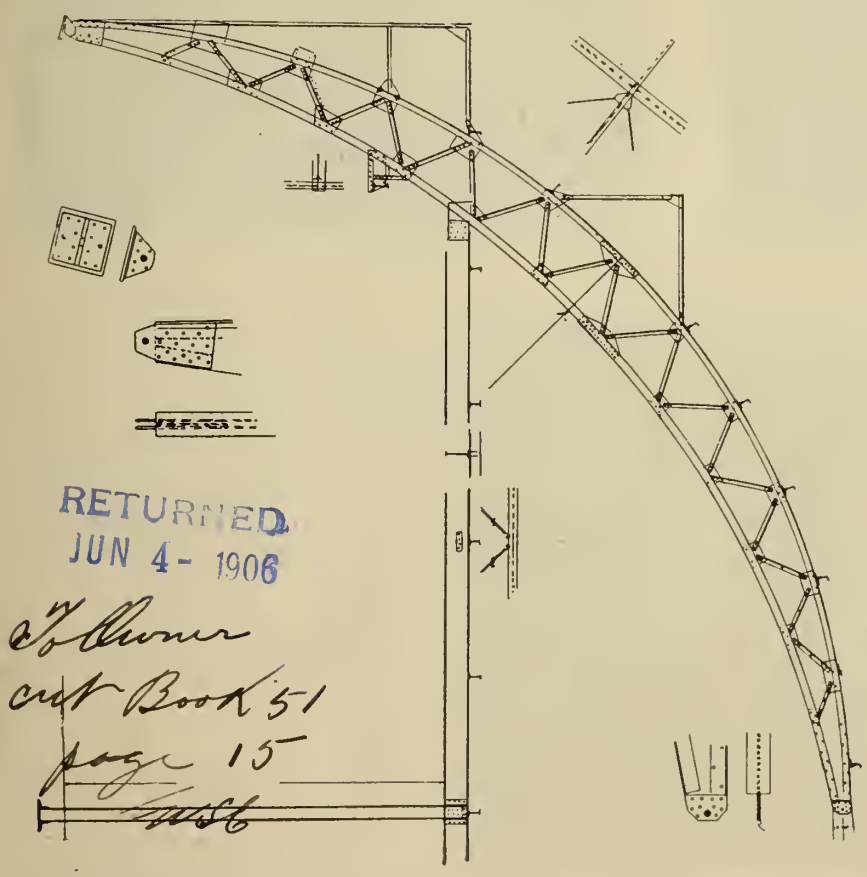
As the land upon which this new building was erected last Summer had been reclaimed from the bay, it was necessary to take particular precautions in conection with the foundation. This was done by pile-driving the entire ground surface and covering the whole with concrete, thus the property that had before been of little value was now made into a busy manufacturing centre. The building itself, as is shown in the diagram and from the photograph, is of semi-circular construction, even the window frames being of steel. The exterior



Plant of Polson Iron Works.—Plan of Machine Shop.

RETURNED
JUN 4 - 1906

apartment fully equipped with all the tools for a planing mill, on the ground floor. The upper storey is fitted up for pattern makers and joiners and contains a full assortment of machinery required for this purpose. Beyond the woodworking shed and towards the water, is situated the pattern storage building, 160 feet long, 60 feet wide and two storeys high, fitted from floor to roof with the accumulation of twenty-five years of patterns, costing hundreds of thousands of dollars.



RETURNED
JUN 4 - 1906
Book 51
page 15

Plant of Polson Iron Works.—Diagram sh wing Method of Construction.

is of galvanized iron, thus making the structure entirely fire proof, and hence no insurance against fire is necessary.

Adjoining this is the woodworking

The main ship building structure presents a busy appearance. One of the particular features is the abundance of light available for the work in hand, as almost the entire walls and ends are of glass. This last feature is one that is becoming recognized more and more as an absolute necessity for high-class manufacture. On the ground floor are installed hammers, punching shears, counter sinking, drilling, plate edge planing, rolling and plate straightening machinery, some of which are shown in the illustration. These machines are all operated by electricity, except in the case of the steam punches and rivetters. One of the most important apartments is the frame forming which is carried on at the sound end of the building. Here is situated the immense furnace where the frames are heated to their proper heat and immediately in front the metal platform on which they are bent to pattern and conforming to the curve required with the exactness of a small fraction of an inch. Nearby, two boilers supply power to some of the self-acting machines and also heat for the plan-mold loft, the second storey of this building, where all the lines of a ship are laid down full size.

Probably the most notable feature in connection with the ship building yards and without which the economic carrying on of the operations necessary for the erection of the craft would be impossible, is an enormous traveling gantry, size of which has already been given, which has a lift of 50 tons at the centre, travels over 400 feet per minute, traverses its load across a span of 75 feet in one minute, and can raise five ton 50 feet high in the same time. It is operated by three electric motors, one for each motion. It travels on 80 pound rails, and from its different proportions has been built to last. It is said to be the best of its kind in the country and was

made and designed by the engineers of the firm.

Recently this firm has completed a large Government dredge 137 x 44 feet, with 24-inch suction, and another for the city of Toronto, somewhat smaller, having a length of 90 feet with 30 foot beam and 25-inch suction. The large ferry boat, Bluebell, the advent of which Torontonians had looked to with expectation, has recently been launched from these yards. It is 150 feet long, 45 feet beam, entirely of steel. Amongst other boats in course of construction is a stern wheeler, 65 feet by 17 feet, for Lake St. John.

The above description will give the reader some idea of a works, while not on an enormous scale, are still of a size to turn out a large quantity of work, and at the same time, with a growing country, contain possibilities for expansion that are almost without limit.

at 440 volts alternating current being adopted. The power plant to generate the electricity for power purposes is

Double Punch in Operation.

k.w. and 220 k.w. generators, respectively. These engines are of the compound condensing type and will use superheated steam. Besides supplying power, these generators will light the works with about 500 incandescent lights and 125 arc lights. A complete sprinkling equipment with a 50,000 gallon tank on a steel tower is another feature as well as a 1,000 Underwriters' fire pump. The brick stack at the power house will be 110 feet high with a 66-inch inside diameter.

At present the Frost & Wood Co. are calling for tenders for boilers, generators and a large complement of iron and wood working machinery.

Edmonton is having plans prepared for a $115,000 waterworks plant.

Some Engines under Construction.

Heavy Flanging Machine.

FROST & WOOD'S NEW PLANT.

Frost & Wood Co., Smith's Falls, have now well under way a larger plant than ever to replace the one destroyed by fire recently. The new building in course of erection is to be a four-storey brick structure of standard slow burning mill construction, with no openings in the floors, having a floor area of between 140 and 150 thousand square feet. The new buildings are so designed as to give a maximum production, with minimum handling. One feature is that the elevators, stairways, lavatories will all be in fire proof towers outside the building. The roofs are to be of felt and gravel. The best systems of drainage and ventilation are being installed. The heating is to be effected with exhaust steam probably by direct radiation. When completed the firm will employ 500 hands in their new works.

The entire plant will be electrically driven, a system of motor group drives

Hydraulic Rivetter.

isolated from the other building. Two Bellis & Morcom high-speed engines are being installed, direct connected to 140

FINE PUMPING STATION.

Railroads replaced the stage coach, trolley superseded the horse cars—and the new turbine pumps and power are taking the place of the fire engines. This system has been a complete success in Philadelphia, where it was first tested, and the city of Toronto decided to do away with the fire engines in the down-town districts and put in the steam turbines.

The turbine pumps now building have a capacity of 5,000,000 gallons of water every 24 hours, at a maximum pressure of 300 pounds to the square inch. The water will be supplied to a high pressure piping net work, covering the district to be protected.

The pumps are always ready to work—the steam is up—and when fire breaks out, all that is necessary is to couple on the hose to the fire plugs, and the water pours out. This does away with fire engines altogether.

The Canadian Westinghouse Company

have the contract for this new pumping station and are supplying two 1,100 horse - power Westinghouse - Parsons steam turbines.

In the specifications, drawn up by the city engineer, it was stipulated that turbine and pump must be so constructed that either could be examined for repairs without disturbing the other half of the unit.

The pumps are of the two-stage turbine type and manufactured by the John McDougall Caledonia Iron Works of Montreal.

A striking feature of this system — which is impossible with fire engines— is the diffusion valves. In cases of large fires, and tall buildings, the two pressure stages will be operated in series; where lower pressure is desired, the speed of the unit will be reduced in proportion. By means of electrically controlled valves, a stream of water under low pressure for say the first storey of a burning building, and another stream under high pressure for the sixth, eighth or tenth storey, may be secured from the same plug by varying the pressure at the pumping station.

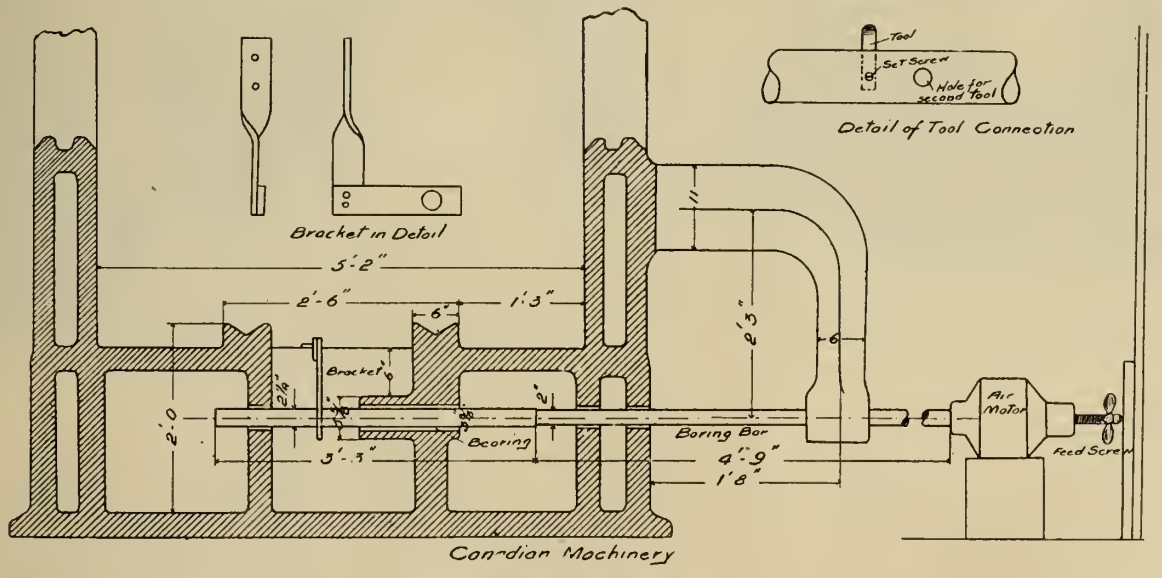
This system, as originated in Canada by the Canadian Westinghouse Company, will give Toronto the most up-to-date fire fighting apparatus in the Dominion—and will do much to prevent a repetition of the disastrous conflagration which lately destroyed a large section of the business district.

BORING OUT BEARING IN PLANER BED.

A DEVICE used for re-boring a worn bearing in a large rail-planer bed by Stanley Price in the G.T.R. shops in Toronto will be of interest to readers of Canadian Machinery.

Detail of Construction
Shipbuilding Plant.
Polson Works.

Referring to the sketch below, the pair of loose and tight pulleys are situated between the large bracket arm and the planer bed. The driving shaft ran through the holes shown in the planer bed, and through the bearing marked. On the shaft to the left of the bearing was a pinion meshing with a gear which transmitted motion to the planer table. Owing to the wear in the bearing, the pinion got out of alignment, and in consequence the teeth in the gear and pinion jammed and broke. The bearing had to be re-bored, and the method adopted is shown in the sketch. The driving mechanism was removed, and a boring-bar replaced the driving shaft as shown. The right end of the bar was supported and guided by the bearing in the bracket arm, while the other end was supported and guided by a bracket gotten up for that purpose. The bracket consists, as is shown in the sketch, of two pieces of iron bolted together, one piece being twisted around in order that it may be bolted to the bed. This bracket may easily be adjusted if, instead of circular holes as shown, slots were made in the bracket, when the bracket could be adjusted in two directions. There were receptacles in the bar for two tools, the tools being held in position by set screws, as shown in the sketch; but only one tool was used here. The boring-bar was driven by an air motor, connected as shown. This motor is of the triple oscillating cylinder type, cranks and cylinders being placed at 120 degrees. The boring-bar was fed by means of the screw in the motor. The back of the screw was jammed against a board held tightly in position, and when the motor had reached the end of the screw, the screw was screwed in again, and again blocked up. The speed of the motor was regulated by regulating air supply according to the cut taken by the tool.



Boring out Bearing on Planer Bed.

W. H. Banfield & Sons, Adelaide street, Toronto, are entering into competition with the American manufacturers on their own ground. Quite recently they have shipped a large order of dies, tools and special forms to the Siche Gas Co., Plainfield, N.J., this order having been received in competition with U. S. firms.

In this way a very complete job was effected.

"A salutation by the way costs nothing. Unlike most things that cost nothing, it is delightful to the one who receives it. A cheery good morning from a passer on a lonely road goes far toward making not only the morning, but the whole day good."

Laying Corner Stone at Niagara

ON May 9th the captains of industry who invested their money in furthering the great power scheme of the Electrical Development Co. at Niagara Falls, Ont., had the satisfaction of seeing the corner stone of the power house laid. About 100 prominent citizens of Toronto traveled to the Falls on that day and watched with interest the notable ceremony, the main stone being laid by His Honor William Mortimer Clark, Lieutenant-Governor of Ontario, and two others by Sir Henry Pellatt, president, and Mr. Frederick Nicholls, managing director, of the company. When completed this power house will be the handsomest of its kind in the world, and will be a credit not only to the company, but an ornament to the park on the Canadian side. It is built after plans submitted to the Niagara Falls Park Commission by Architect Lennox, and will contain the largest generators in the world.

The Electrical Development Co. was incorporated on the 18th of February, 1904, and on the 2nd of April of the same year work was begun on construction. The plant is situated near Tempest Point, about one-half mile above Horse Shoe Falls at the foot of the Rapids.

After the ceremony the visitors were conducted to the other power houses on the Canadian side and finally inspected the plant of the Electrical Development Co., going down and through the enormous tunnel which was built at great hazard to act as a tail race. Following this a luncheon was served at the Hospice of Mount Carmel, being presided over by Sir Henry Pellatt, and greatly enjoyed by all present. After the toast to the King had been drunk, speeches were made by the Lieut.-Governor, Mr. B. E. Walker, Sir Henry Pellatt, Mr. Frederick Nicholls, Mr. W. R. Brock, and Mayor Cutler, of Niagara Falls, N.Y. As the power bill had been introduced in the Ontario Legislature the day before, and being the most prominent topic of the day, considerable reference was made to it during the progress of the discourses. It was contended very strongly by Sir Henry Pellatt that the power bill would undoubtedly have the effect of driving away British capital and make it impossible to float further schemes on the ambitious scale carried out at the present instance.

The debt the country owed the men who had exercised faith in this development, and who had had the courage to invest their millions in it, was not forgotten, and no small tribute was paid them on this occasion.

In the course of his speech Mr. Frederick Nicholls gave probably the first public announcement of the events leading up to the undertaking. While speaking historically the facts as related demonstrated very clearly the keen foresight and judgment of the man who had conceived and carried out the early negotiations that were to culminate in this great undertaking.

RETURNED
JUN 4 - 1906
To Assn
Cat Book 51
page 25
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Laying the Corner Stone of the Electrical Development Company's Power House, Niagara Falls, Ont., May 8th, 1906.

OUR CONVERSATION.

"Conversation is an art worth learning. Its keynote is unselfishness. To speak without trumpeting our opinions, and to listen without interrupting, are accomplishments which a selfish person finds difficult, but which must be learned before the charm of conversation commences."

Foundry Practice

MODERN IDEAS FOR THE TRADE.

THE EFFECT OF MANGANESE ON LOW SILICON ORE*

By M. J. Walsh, Secy. Montreal Foundry Foremen's Association.

In cast iron having from 0.50 per cent. to 0.70 per cent. silicon, the addition of manganese above 1.38 per cent. gradually hardens the metal, the combined carbon and the chill increasing with the addition of manganese. When the manganese is high and the casting large enough to be gray, the fracture is open and coarse, and the graphite scales very large and crystalline. High manganese to a certain extent prevents the absorption of sulphur from coke. When manganese is below 1.30 per cent. (this percentage is only approximate and depends largely upon the percentage of silicon present; the lower the silicon, the sooner the manganese will commence hardening iron) its action is different; it softens iron, lowers the combined carbon and decreases the chill; this effect is more marked where the sulphur is high.

Manganese may be used for decreasing or increasing the chill, depending upon the nature of the mixture and the amount of manganese used. Very hot metal, stirring and skimming form sulphur reduction. Manganese can be used to advantage in low silicon and chilling iron in the following cases: In mixtures where the percentage of scrap is large and the sulphur necessarily high (this will occur in a car-wheel mixture, where usually a large portion of old metal is used) the results of this increase in manganese would be a lower sulphur, lower combined carbon, less chill and greater strength. Very often chilled plates are required, having hard chilled faces and soft backs suitable for planing. Manganese added in the right proportion will reduce the tendency to mottle and make a comparatively soft graphitic back. In all cases where chilling irons are melted and the sulphur is over 0.07 per cent. the iron can be strengthened by the use of ferro-manganese or pig iron having a high precentage of manganese. In the manufacture of large hydraulic cylinders the manganese should be kept low, as it is necessary to have a close mottled iron to withstand the pressure and prevent leakage.

Phosphorus has practically no effect upon the grade of iron as determined by fracture. As phosphorus increases total carbon decreases, and the normal amount of carbon varies from about 3.75 per cent. in normal hematites down to about 3.30 per cent. in normal Cleveland irons containing 4.5 per cent. phosphorus; that is, with an increase of 1.5 per cent. phosphorus there is an increase of 0.45 per cent. of total carbon. Phosphorus has no effect upon combined carbon, but as phosphorus increases the iron shows a lighter color, due to the phosphite of iron present.

Usual Composition of Castings.

It is by no means necessary when in any particular district, to turn out castings of the same analysis as would be done in another district where the irons within reach of the founder may be different in composition. In those districts where high phosphorus irons are cheapest, phosphorus will be found to be higher in the general output of castings than is the case where irons of a lower phosphorus content are cheaper. The same also applies to manganese.

Castings for machinery and general engineering work vary greatly in composition in different districts, but as a general rule the phosphorus averages about one per cent. Manganese usually varies from 0.3 per cent. to 1.5 per cent., but the average is about 0.7 per cent. Silicon may vary from 1.0 per cent. to 3.0 per cent. Average is 1.8 per cent. Total carbon varies to a very great extent. In some cases the total carbon is entirely in the form of graphite, in others the greater part may be combined. It may vary largely in the same casting. Sulphur usually varies from 0.03 per cent. to 0.15 per cent. In special engineering castings, where great strength is required, total carbon, manganese, silicon and phosphorus are all low usually.

For castings required to be soft and tough, hematite iron alone is used. (Low (0.027 per cent.) in phosphorus not necessarily low in manganese).

Iron for special castings is in some cases remelted once or twice before casting. This is only necessary when a higher grade of iron than is required is being used. Where reasonable care is taken in the weighing of all materials charged into the furnace, the results will be quite as regular without this remelting. The effect of remelting in the cupola is equivalent to lowering the grade. Usually silicon is decreased 0.2 per cent. to 0.3 per cent. Sulphur usually increases to the extent of 0.02 per cent. to 0.04 per cent. About 25 per cent. of the manganese is lost. Total carbon increases or decreases according to the amount present, whether below or above the normal.

Phosphorus.

A very slight amount of phosphorus is absorbed from fuel by iron in melting. It is practically a constant quantity, the small increase being proportionate to the amount of phosphorus in the fuel.

Manganese loses in passing through a cupola. Its action is that of a protector from oxidation, and the amount lost in passing through depends upon the amount of blast and also upon the percentage of sulphur in the fuel. The greater the amount of air forced into the molten metal the more manganese is lost as an oxide. The greater the percentage of sulphur in the fuel the greater will be the percentage of manganese passing into the slag as a sulphide. Manganese is not united with iron as a compound, it is rather alloyed with it, having practically no affinity for the iron.

Carbon.

Iron may lose or gain carbon in melting. This is governed by the composition of the iron and the conditions or method of melting. An iron while passing down a cupola has a portion of its carbon burnt off, the quantity depending upon the amount of blast and the time which the iron takes to pass through the zone of the cupola where the oxidizing influences are at work. After having a portion of its carbon removed the molten iron comes into contact with the incandescent coke in the bed, and from this it absorbs carbon. The hotter the iron the larger the amount of fuel, and the longer the iron remains in contact with this fuel the more carbon it will absorb. If the amount of fuel is sufficient, the iron may absorb more carbon than it loses in passing the tuyeres. If, however, the blast be heavy, and the ratio of fuel to iron small, the iron will lose more carbon in passing through the oxidizing zone than it can possibly pick up from the bed. Melting with high blast and low percentage of coke will cause a loss of carbon while low blast and high percentage of coke will cause a gain.

*Read at a recent meeting of the Association.

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and Manufacturing News

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THE ONTARIO POWER BILL PASSED.

THE much talked of power bill of the Ontario Legislature has become law. It has been denounced by some as an attempt at socialism and railed at by others as a weak effort to bring into line the existing power companies at Niagara. These are extreme views and in no way reflect the judgment of the great majority of interested parties—and the number interested includes every thinking man in the province. In the main the bill is a compromise between the natural rights of the people of the province and the vested rights of the capitalists who have undertaken the enormous developments. While the question is being discussed and thought of in connection with Niagara and the western peninsula of Ontario alone, since it is there the test of its feasibility will be made, the entire province will be equally affected, as the bill applies to all water power.

Ontario's industrial future unquestionably hangs in the balance with the decision regarding the disposal of her water powers and a reasonable decision as regards permanency and stability to manufacture and the promotion of industry has been given.

The first clause of the bill provides that the Government shall appoint a hydro-electric power commission, one of the three members of which shall be a Cabinet minister, the province to pay the salaries of the commission and for electrical and financial experts. The commission is to supply estimates to any municipality desirous of securing electric power from any water fall, and this estimate shall be furnished in detail. If the municipality determines that the price quoted is reasonable and is willing to enter into contract for a block of power the matter shall be submitted to the electors by the municipal council, and if the vote be negative negotiations will end. If the electors agree to the necessary expenditure the council is empowered to make the contract for the power required. Transmission lines, transformers, and the necessary equipment will be supplied by the commission on the credit of the province, this expenditure to be provided by the municipality by its paying the commission 4 per cent. interest annually, a sinking fund sufficient to wipe out the indebtedness in thirty years and an annual maintenance or renewal charge on the plant. The commission shall fix the rates and the consumers shall pay the municipality for power. In addition to municipalities the commission will have the power to supply electric energy to any railway or private company distributing electricity. Thus if a town decline to take up the matter with the commission private individuals in the town might do so. The clause giving the commission power to demand electric energy from the power companies on peril of the expropriation of the work has aroused the greatest discussion. This as well as the power to expropriate transmission lines insures finally the safeguarding against high rates, either for energy at the water fall or an unreasonable price for its transmission.

In this there is evidently no attempt on the part of the Government to force the existing developing companies to part with their property at a loss or to generate electricity at a price that will not be fair to all concerned. What the bill does aim at, and which if carried out it will surely secure, is that the manufacturing interests of the country will be able to secure power at a rate to enable them to make the Province of Ontario a hive of industrial activity. In the carrying out of this no British or other foreign capital should be frightened away. The matter should be looked upon as a partnership between the people of the province and the developing companies, with the Government commission as managing directors of the agreement.

THE FIELD FOR PRODUCER GAS.

IN Canada, and especially in Ontario, at present the one power topic is electric power. It is being discussed privately, publicly, in the press and in the Legislature. But while this is so, there is another form of power which will have no mean future in Canada, even as compared with electric power. This is producer gas. Of late years the attention of engineers and manufacturers in Canada has been more and more directed to producer gas as an economical and efficient form of power, with the result that experimental work upon producer gas plants was started and companies formed to manufacture them. Thus far any gas plants that have been installed in Canada are European design, and probably any that will be developed within the next few years will be after the style of some of the English gas plants. Already several firms have been organized and are manufacturing, or making arrangements to manufacture, producer gas plants in Canada either under English, German or United States patents. Not only are manufactories starting up, but consulting engineers are paying considerable attention to the matter; some even making a specialty of gas plants.

In the face of this evidence a good future for producer gas in Canada seems assured, but it is more the inherent qualifications of producer gas itself as a source of power that leads one to predict great things for it. The prime question in regard to power is its comparative cost, and in this respect it would appear that producer gas is exceptionally satisfactory. Tests made upon gas engines developed by English manufacturers especially to operate upon producer gas showed as low a coal consumption as 0.83 pounds of Scotch anthracite pea coal per brake horse-power, engine running under full load, and 0.91 pounds per brake horse-power, engine running under half load. Producer gas plants have by no means reached perfection, nor have gas engines, and even better economy than this may be expected with the further improvement of the plant and engines. Another important point in a power question is the reliability of the power plant and cost of maintenance. In this respect also the producer gas plant appears to give satisfaction. Of course the gas plant has not reached the state of perfection that the steam plant has, and consequently it is possible for something to go wrong, for which there is no "rule of thumb" remedy; and while expert labor is not required to look after the plant, it should not be left in charge of anyone not having knowledge of the difficulties to be met in the operation of it.

Experiments have shown that the gas plant can be brought to full working load in a remarkably short time. Starting with the producer cold and empty, a gas producer made by an English firm attained under full working load in less than 15 minutes. This was under test, and it is not to be expected that in actual practice this could be done, but this gives an idea of the qualifications of the gas plant in this respect.

PROBLEM OF THE LARGE GAS ENGINE.

WHILE only rich coal gas was used in gas engines, their field of usefulness seemed limited to the smaller sizes, since only then could they compete in economy with the steam engine. With the utilization of cheap forms of gas, such as blast furnace and producer gas, as a fuel in internal combustion motors the gas engine industry started a revolutionary movement. This commenced in Germany and Belgium and spread to other European countries and England. Quite recently manufacturers in the United States followed Germany's lead, and now there are firms in Canada prepared to build these large gas engines when the occasion demands. With the development of these immense units in the gas engine line many difficulties were met with by the designers and manufacturers never thought of in the small units; and, indeed, such radical changes have been made in some of the large gas engines during their development as to make them scarcely recognizable as originating from the ordinary small Otto cycle gas engine.

There are two distinct styles of large gas engines, those operating upon the Otto cycle and those operating upon what is commonly known as the two-cycle. The attempt was made to develop the engine by keeping to a single cylinder and increasing its size. This style showed economy in both gas consumption and floor space, but owing to the difficulty of balancing the moving parts in the large engines and other reasons it was found advisable to create large units by combining several cylinders in various arrangements. It was also found advisable to make the engine double acting instead of single and to place cylinders in tandem, because of the finer speed regulation obtainable. It being desired to adapt the gas engine to the operation of electric dynamos, minute regulation of speed under varying load was required, and this led to the development of efficient governing mechanisms, the most efficient being probably the Mees system used on some French and German engines.

A few of the fundamental difficulties met with in the development of these large engines were in connection with the design of the frame, in the construction and operation of the valves and valve gear, in the cooling of the parts in contact with the hot gases, in the circulation of the cooling water and in the starting of the engine. Most of the firms developing these engines had had previous experience in the construction of large steam engines, and this was of value in designing the gas engine frames. The valves are mechanically operated, cone seated, poppet valves. A question not yet definitely decided is whether it is not more advisable to have the valve gear operated by eccentric motion instead of cam and roller mechanism. In these large engines it is essential that all parts coming in contact with the hot gases should be water cooled and for that reason the cylinders, the pistons, the piston rods, the stuffing boxes and the valves must be water jacketed. On the large engines the circulating pumps are driven from the main shaft of the engine and not from the valve shaft, but it is now becoming common practice to drive the pump by electric motor. There are two common methods of starting the engines. One is to use one cylinder of the engine as a compressed air motor, until a charge has been ignited in the other cylinder or cylinders; but the most popular method is to start the engine with an electric motor, a pinion on the motor shaft meshing with gear teeth on the fly wheel.

FEW MANUFACTURERS IN PARLIAMENT.

NO body of equal importance and representing equal interests in the country is less represented in Parliament than our manufacturers. They are carrying on great industries, employing thousands of hands and building up the country in a stable manner, and yet in the great body of parliamentarians you will find them but very slightly represented. The main reason of this may be that those at the head of our industries are too engrossed to take an active part in the country's affairs. What we would like to see would be a larger sprinkling of manufacturers both in the Dominion and Provincial Legislatures. Their influence could not fail to be for good, and it is hoped that more manufacturers may decide to enter public life and help in a broader measure than they may even now be doing to advance the industrial interests of the Dominion.

UNIVERSITY AUTHORITIES OBJECT.

IN an editorial entitled "Useless Energy for Technical Students," appearing in last issue of Canadian Machinery, reference was made to the loose methods in vogue in the engineering department in one of our Canadian universities. Both the authorities of McGill University and Queen's took exception to this on the ground that it might refer to them, but it did not. As this places the matter on the head of the one large remaining university with a science department we hope the editorial in question will have the desired effect and that no more complaint will be possible regarding lax methods of instruction.

Milling Cutters; How They are Made Used and Abused.

By John Edgar.

ARTICLE II.

IN selecting cutters for any particular job there are several points to which we must pay special attention. The most important of these is the grade of finish the work requires.

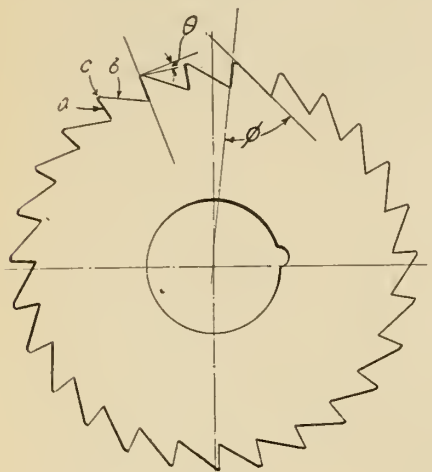


Fig 5

On this one point hinges whether the equipment will cost much or little. If the finish is of a coarse character the cutters may be made more cheaply, not so much by reason of difference in quality but rather in quantity, since the rough work would require but one set of cutters because but one cut would be necessary, whereas should the quality of work be such that the range between the limits set for accuracy be small we would require two sets of cutters, one for removing the bulk of the stock and the other for finishing the piece to size.

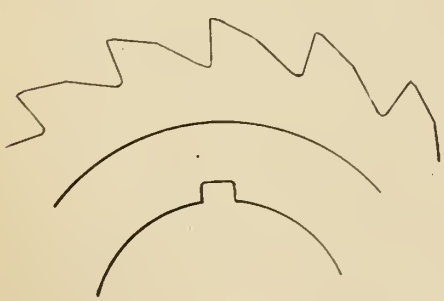


Fig 6

Much depends, too, on the facilities at hand for milling the work. Some jobs may be more easily worked on a vertical milling machine, but there may be no such machine at hand, or at least it may not be open to receive the work as we want it. In milling a large surface we have two methods to resort to in most cases. These are, first, the use of a horizontal spindle machine, which will require a set of very expensive cutters, while for a second method we have the vertical machine, which requires a cutter of much less expensive make. We may resort to the same style cutter that would be used in a vertical spindle machine when we have none but horizontal machines at hand, but the setting of the work may take a very complicated form in trying to use such a cutter for this purpose.

In selecting cutters it is important to keep the diameters down as small as possible. This is not only important from the standpoint of first cost, but from the time saved in the feed, especially so where short cuts are made, and from the economy of power required for a given amount of chips removed.

In making up gang of cutters it should be made a point to have the cutters as near the same diameter as possible because there are speeds at which cutters work best, and a variation either side of this speed produces poor results. But where it is impossible to overcome this fault the large cutters should be speeded up to the limit so that the smaller cutters may come as near as possible to the ideal speed, otherwise they will tear the work, leaving a ragged surface. The slower a cutter runs the greater should be the number of teeth in proportion to the diameter.

All these things are dependent on the work in hand, and cannot be dealt with in a general manner.

Explanation of Terms.

Before we enter into the question of the construction of the cutter a brief description of some of the terms that are used in connection with them will not be out of order. In figure 5 is shown an end view of a milling cutter. The different parts of the tooth are lettered, (a) being the face of the tooth, (b) the back of the tooth, (c) being the land, (ϕ) being the angle of the tooth, (θ) the angle of clearance, The angle

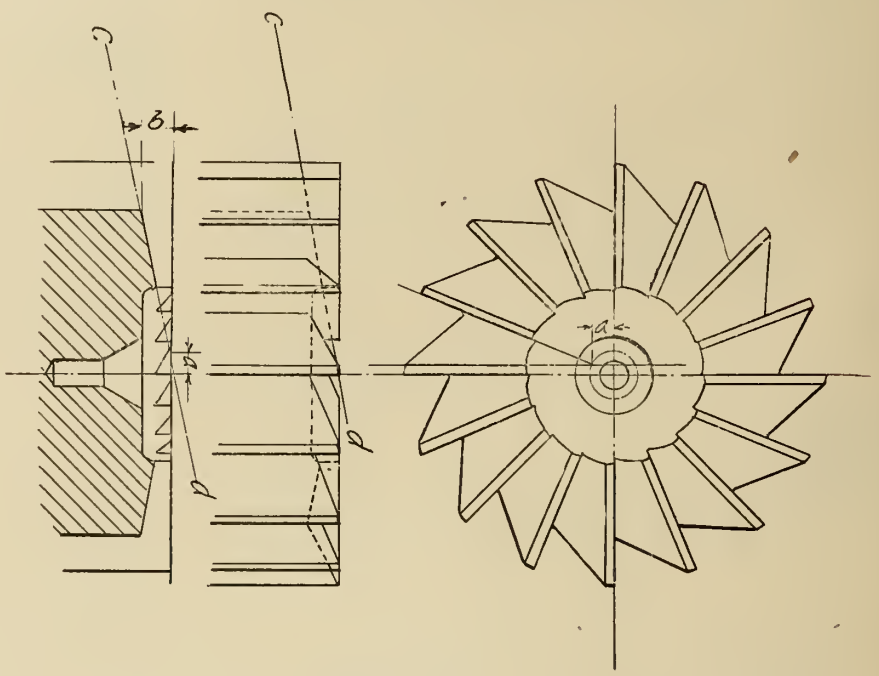


Fig 7

of tooth (ϕ) is usually made about 50 degrees, but of course varies, as it would be impractical to make a different cutter for each diameter cutter to be cut. The angle of clearance varies from 3 to 9 degrees, the larger value being used on roughing cutters. The land (c) is generally made about 1-32 or 3-64 of an inch wide at the first grinding.

Number of Teeth.

The number of teeth in a cutter has been for some time a bone of contention among different authorities, but the average values of various manufactures of cutters on this continent are those given in the table.

TABLE I.

Diameter of Cutter.	Number of Teeth.	Diameter of Cutter	Number of Teeth.
½ in.	6	2½ in.	21
¾ "	8	3 "	24
1 "	12	3½ "	26
1¼ "	14	4 "	28
1½ "	16	5 "	30
2 "	18	6 "	32

While the above figures are the general practice, it will be found to advantage in the cases of cutters of 3 in. and over, when used on cast iron, to make them with fewer teeth, especially so for roughing work. When extra heavy work is to be done with a cutter the teeth are sometimes made the shape as those shown in Fig. 6, which are much stronger than the regular single cut

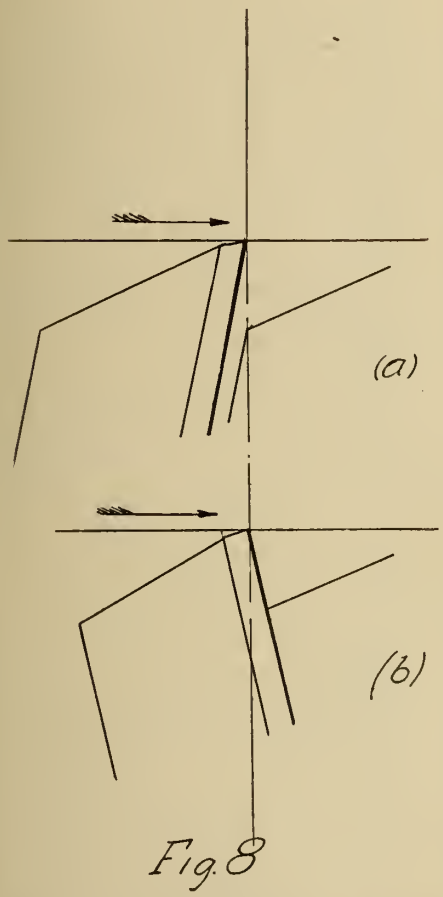


Fig. 8

teeth. It is important that all cutters be made with a fillet of considerable size at the root of the tooth as this is an exceedingly weak point, and if a fillet is not allowed the cutter is liable to crack in hardening.

Finding Angle.

In designing end and side milling cutters it is necessary that the land on the side and end teeth be of uniform width from the circumference toward the centre. This is accomplished by making the cut at an angle as shown in Fig. 7. The proper angle for this cut may be found by laying out the cutter as shown. The radial line adjacent to the face of the tooth is produced to intersect the line adjacent to the back of the land. At this point of intersection the cut line (cd) should intersect the plane of the end teeth. The depth of the cut (b) determines the angle of this line.

Some Requirements.

The majority of end mills are made with spiral teeth. For ordinary purposes this spiral should be of the same hand as the cutter, that is, a right hand cutter should be cut on a right hand spiral, but for die sinking and on similar work, where a line is used as a guide, the spiral should be opposite to the cutter, that is, a right hand cutter should be cut with a left hand spiral, since the direction of the spiral will then be against the face of the work, forcing the metal away from it, leaving no burr to cover the line, as would be the case where the conditions are different. Where milling is to be done with the end teeth the former is the way they should be cut, as is easily seen from Fig. 8. The case (a) has a good front rake, while (b) has a back or negative rake, which would produce a scraping action instead of the clean cutting action that is desired.

Large Millers.

When cutters reach the 6 inches in diameter it is good practice to make them with inserted teeth. This is done as a matter of economy, both for reasons of first cost and subsequent maintenance. There are several ways of holding the teeth, some of which are shown in Fig. 9. That at (a) is the simplest and answers the purpose very well. As will be seen the taper pin is driven into the slot, which causes some expansion, binding the cutter blade securely in its seat. When new ones are to be put in place or the old ones adjusted it may be accomplished by merely removing the taper pin. What could be simpler? The method shown at (b) is another good way to accomplish the desired result. The taper bushing is drawn down into the taper seat, and bearing on the blade causes it to be secured to its seat in a rigid manner. Another simple way of holding the blades is by the aid of a gib such as shown at (c). The above are three widely different ways of doing the same thing, and represent the practice of as many different cutter manufacturers.

It is apparent that owing to their construction inserted tooth cutters must have less teeth in proportion to their diameters than the solid cutters. The table below gives the general practice in regard to this point.

Inserted Tooth Cutters.

TABLE II.

Diameter of Cutter.	Number of Teeth.	Diameter of Cutter.	Number of Teeth.
6 in.	12	10	20
7 "	14	12	24
8 "	16	14	28
9 "	18	16	32

These figures give as the pitch of the teeth 1.5-2 inches, which is ample for the designs given, and where the bodies are made of steel may be somewhat shorter, that is, the number of teeth may be increased.

When it is desired to have the cutting faces of inserted tooth mills on a spiral we must proceed as follows: The blanks are first slotted out on an angle, which

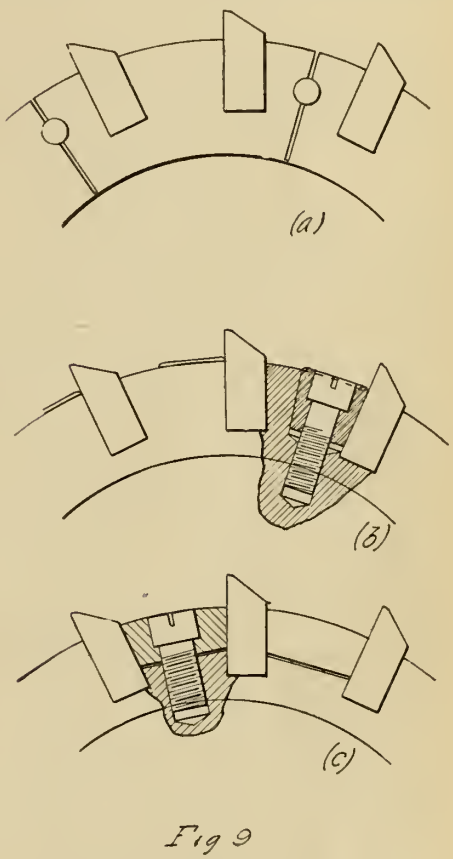


Fig 9

is usually made about 12 degrees, the width of the slot and the teeth being slightly wider than when the teeth are set parallel to the axis of the cutter, the teeth are then set in and secured, and a spiral cut is then taken over the face as in the ordinary solid spiral milling cutter. If the angle is made much more than 12 degrees the twist in the spiral cut will be more, and consequently the ends of the tooth will be much thinner.

In the next article we shall take up the setting of the machine and the different methods used in making the cutter.

The Uses of Electricity in the Modern Shop*

By Galvin W. Rice, Cousulting Engineer of the New York Office of the General Electric Company.

THIS is a large subject, too varied to be treated in an evening, much less in the few minutes allotted. However there is an opportunity to bring out a few points. First of all, I wish to emphasize the engineering side, which in reality is the foundation of the successful application of electricity, or of any of the forces of nature to the uses of man. Second, make a servant of the force of nature rather than permit it to be your master, whether it be electricity or gravitation, and whether the application can best be made directly or through a hydraulic or a pneumatic medium.

The intent of these two features of my remarks, namely, the engineering side and the attitude of mind which makes it possible for one to utilize any force according as it is the most available, will be better appreciated as I progress. I shall be satisfied if these two things are all you remember of my remarks.

We are just now hearing in Germany and other foreign countries of the American evil; but may we not as truthfully beware of the German evil, with their groundwork of technical training? One obtains at a technical school fair instruction in the laws of electricity and an opportunity at least to become acquainted with electrical machinery, but this is not sufficient. In fact, it is the absence of the above important factors which is the reason for our not attaining even greater progress. You will have no failures in applications if the engineering side is first thoroughly studied, and then the apparatus intelligently installed.

The first question to decide is, what is the length of time for which such a plant will be used after constructed and how can it later be increased? Always have in mind what you may be required to do when successful, and when the improvements which you have instituted shall have produced the expected increased output.

Value of Motor Drive.

Electricity is now almost universally employed in some form or other in industrial work. At another place I am speaking of the economies which are secured by means of electric drive over that by belts and shafts. In this connection it is well to emphasize the improvement in general lighting due to the absence of belts and the convenience of direct connected units, which has a distinct commercial value. Another important point is in the saving of the capacity of the prime mover on account of the fact that almost never are all the motors required to operate at full load at any one moment. Consequently, it is good engineering to install the generator of perhaps not more than two-thirds of the capacity of the connected load, but this relation varies according to the industry.

Another important advantage of electric drive is in the uniformity of speed which may be secured, which not only improves the quality of the product but also the quantity, this latter feature being due both to the uniform speed and to the fact that there are fewer defects in the output. This is peculiarly true of all weaving, whether of cotton, wool or silk, and in the spinning of the same, also of all paper manufacture. Expert may detect particular machine.

I am aware, from the letter of your chairman, that there is represented here this evening the greatest variety of industries, but I feel safe in saying that there is almost no industry which may not be benefitted by the application of electricity in some form. it may be in an addition to an old mill, if not complete equipment of a new mill. The prime mover may be steam, water or gas. Motors may be belted or direct connected. There is the greatest possible range of speed, secured economically, quickly, and conveniently. All the machinery may be electrically driven or only a part. Portions of a plant or whole buildings may be electrically driven while other portions may continue to be driven as they are now; or it may be best to install a separate steam plant, keeping in mind always to do that which is best after having considered every point of view; some of the apparatus may be electrically operated directly, or through some other medium. For example, elevators may have a motor direct connected to the worm gear, or the motors may operate pumps on enclosed tank system which in turn actuate the elevator. The combination of electrical and mechanical methods is always considered.

In passing, I wish to speak of the nicety to which starting and controlling devices have been elaborated, so that there are to-day several large and successful firms engaged solely in the business of designing and building such apparatus.

These are so arranged that they provide for an excess pressure, or for no pressure, and also for overload. They are fool proof, so that any attendant, no matter how youthful or inexperienced, may operate them. An instance of this is in the elevated and subway roads in New York City, where a multiple unit control of motor cars has been substituted for steam locomotives. A large number of steam engineers would otherwise have been thrown out of employment, but instead gradually were instructed in the use of the electric controller so that they have resumed their previous positions, only now being entitled motormen instead of engineers.

Motors may be located on the ceiling, as well as on the floor or on the wall. Self-oiling bearings are universal, and although the best design of direct current motors require little or no attention of the brushes on the commutator, with alternating current motors even this is done away with, so that the minimum of attention is required. Remote control starting devices are installed whenever the motor is inaccessible or otherwise desirable.

For miscellaneous tool work motors may be combined with a portion of the frame, and in some cases entirely housed in the pedestal.

The ability to secure variable speed is now very great. This is particularly necessary in the case of newspaper printing and cloth printing works. The very slow speed, about one-tenth the full speed, is required for the making ready, and there is a slow running speed when time is necessary for the impression, a medium speed for regular work, and a maximum speed for rush work.

Formerly it was quite common to vary the pressure by interposing a resistance in the armature circuit, which in turn varied the speed. This is always an uneconomical method, as practically the same power is consumed regardless of the speed, and the speed was not always steady, and the variation of the same was always within the normal speed of the motor. Now, however, motors are designed for variable speed by changing the field strength. This is quite economical, and the consumption of current is practically proportional to the work done. With this method a range of speed from even 5 to 1 is possible.

The control apparatus for motors is usually extremely simple. For more elaborate work, and at the same time economical operation, there are several systems where a multiple voltage or variable voltage is secured by one or more extra generators.

I have just touched on some of the general phases of the application of electricity. But I want to take up also briefly the future, and the opportunities for everyone within hearing to study the

*Remarks, on Manufacturers' Day, at Niagara Falls, Ont., before the Boards-of-Trade of the Canadian and United States Cities of Niagara Falls.

possibilities in electro-chemical and electro-metallurgical processes.

Electrolytic Possibilities.

It is in this field that there is the greatest reward. Think of the already many successful processes here at the Falls; and they are but a fraction of the possibilities. Take, for instance, aluminum as an example, and all the benefits and possibilities of an electrical process for its manufacture. Fifteen years ago the amount of aluminum made in the United States was 61,000 pounds, valued at about $1.00 per pound; last year the output was 9,000,000 pounds, valued at less than 30c. per pound. Practically all of the copper of the United States is electrolytically refined, with the exception of some ore from the Lake Superior district, but even a portion of it is refined in the works of the Calumet & Hecla Co. located in Buffalo. Some of the products which are, or easily can be, made with electric power are chlorine, bleaching powder, potassium chlorate, sodium chlorate, carborundum, aluminum, artificial graphite, sodium calcium, sodium peroxide, sodium oxone brand, calcium carbide, caustic soda, sodium hypochlorate, barium peroxide, potassium per-carbonate, ferro-titanium, and many ferro alloys. But if you should ask which are the materials to select I say the piration of nitrogen for nitrate or fertilizer and more particularly recommend those which are most used, iron and steel.

Electric Smelting.

You have this much to start on. It is successfully and commercially being manufactured in Sweden, Italy and France. Why not here? You of Canada should be particularly interested, as has been pointed out only a month ago by your able Superintendent of Mines, Dr. Haanel, before the Canadian Club, of Toronto.

He emphasized the favorable conditions in Canada due to the peculiar action of nature in placing large ore deposits in Alberta, Ontario, Saskatchewan and Quebec, but giving you no coal there. You are obliged to go to the coast in either direction for coal, but large water powers are at hand waiting to be developed.

Here is where electricity solves the problem. There is almost no distance to which electricity may not be transmitted. The longest on this continent, and perhaps in the world, is in California, from the Sierras to San Francisco, a distance of upwards of 220 miles, with a pressure of 60,000 volts or more in the Bay Counties System. But it is not necessary to consider these enormous distances, as in most all cases water powers are possible of development, which are nearer by. Canada is most peculiarly and favorably situated in this respect. You are typical of the man whom the Lord gave ten talents. One says there are difficulties. Of course there are. But who cannot overcome them? Watch San Francisco rise.

Carbon for reduction is, however, necessary, and it will be necessary as a part of the problem to develop a process with wood, or from coke made from peat of which there are ample deposits in Ontario and Quebec.

One of the interesting discoveries is that the chief ore in Canada is magnetite, much of which contains too much sulphur for successful smelting in the blast furnace; but on the other hand can be handled successfully by the electric furnace. All of this has been recently determined anew at Sault Ste. Marie under the direction of Dr. Paul Heroult.

The success of this process has already been known, having been given in the report of Dr. Haanel in 1904, which showed that even pig iron could be produced on a commercial scale and compete with the blast furnace, if electric power could be secured as low as ten dollars per H.P. year and coke at $7.00 per ton. These results, however, were determined from furnaces not designed particularly for the work, and since it has been shown that they could be improved upon with a specially designed furnace.

The Lake Superior Power Co. has recently furnished a building and the use of 300 H.P. gratis, and the Canadian Government has co-operated, appropriating $15,000 for tests. These tests on the Canadian ores commenced the middle of this last February, and in the month following about 150 casts were made, from which upwards of 55 tons of pig iron were obtained.

It was determined in these tests that both charcoal and peat coke could be substituted for coke as a reducing agent without being briquetted with the ore. I beg to quote from the concluding paragraphs of Dr. Haanel's address:

"The Government has furnished you with facts on which to base a sound judgment as to the feasibility of commercially engaging in the manufacture of pig iron by the electric process; with that its duty to the nation is done, and it remains with you business men to apply, perfect and profit."

The amount of current per ton of pig produced is about 83 H.P. days per ton of 2,000 pounds. The relation of electric power to the cost of production and the relative importance of the several iron products are as follows:

In the Kjellin process for the manufacture of crucible steel the cost of electrical energy for producing 1,000 kilograms of ingots on a basis of $10 per H.P. year, is $1.48, and the total cost is $37.48, which shows that the cost of electrical energy is comparatively small in this high-class material. Crucible steel made by this process is equal in all respects to the best Sheffield crucible steel, and can be produced at a cost considerably less.

In the Heroult process, which has just been repeated at the Sault Ste. Marie, the fuel consumed in an ordinary Siemens furnace would vary from 1,000 pounds to 1,800 pounds of good slack coal per ton of steel produced. Such coal would probably cost $5.00 to $5.50 per ton of 2,000 pounds in Canada, let us assume 1,200 pounds per ton, would mean, say, $3.00 per ton of steel. The cost of electrical energy at $10 per electrical H.P. year would be $1.53, the electrodes, etc., are estimated at 20c., making a total of $1.73 as against $3.00 for the cost of coal.

Everyone coming to the Falls is impressed with its indescribable grandeur, and considers it an event of his life to have been permitted to witness it. But I am more impressed with the thought of how we may use the benefits that God has lavished upon us.

Availability of Coal.

The criterion, of course, is coal. That is the source of the bulk of our energy that is industrially employed. In the United States from coal and other fuels upwards of nine million horse power is developed for the operation of various plants. Therefore, at your feet you have, by the most conservative calculation, one-fourth of the power of all the steam plants of the United States.

Elsewhere I have spoken of the economy of electric drive, which will now be more apparent in this connection. The efficiency of an ordinary steam driven engine and shaft transmitting power by belts is from 75 per cent. to 50 per cent., and more often the latter, between the brake H.P. of the engine and the work done on the machines. Often I have indicated an engine in a plant at noon-time, when absolutely no work was being done other than driving the belts and shafting, and I have found the load on the engine to be 50 per cent. of that when the shop was running full. There we have a spectacle of the wasteful use of coal. To develop water powers, therefore, is to save coal twice over.

It may not be out of place to mention that we are not always to have coal; its supply is not exhaustless. I do not want to be considered as making wild statements, but I will give a few facts and state the authorities.

In the annual statement of the House of Commons by the Board of Trade is given the average value per ton of the coal mined from the year 1883 to the present, from which I have summarized as follows: In the United Kingdom the price has nearly doubled; but in the case of the English colonies it has decreased, with the exception of Canada, India, and

Australia; however, the relative production of the colonies to the British Isles is less than 1 per cent.; in Canada, India and Australia the production is only 3 per cent. of that of the British Isles. So it may generally be stated that in the British Empire the price of coal is steadily increasing. With all the rest of the world, with two exceptions, it is also increasing, in every case by 10 per cent. and in some 50 per cent.

The two exceptions are Japan and the United States. Now, what relation does the production of Japan have to that of the world? Less than 1 per cent. The United States, on the other hand, produces over one-third of the world's supply. The United States, then, is the only important exception to the steady increase of the price of coal.

The industrial and economical importance to you of these Falls cannot be over-estimated. The opportunity to utilize this magnificent power and the various powers throughout Canada is in the application of electricity. The one of you doing the most good in this world is the one who builds up. The use of coal is reducing the world's supply, which can not be renewed, but to develop water powers is to conserve the supply.

TESTS ON TEMPERING TOOL STEEL.

A Report on the Preliminary Tests made on the Schenker Process of Tempering Tool Steel.
By Prof. H. M. Jaquays.

THE objects of the tests made were: (a) To compare the performance of tool steel when tempered (1) by the Schenker process, and (2) in the manner recommended by the maker. (b) To compare the performance of ordinary low-priced tool steel, tempered by the Schenker process with some high-priced, high-speed tool steel. The steels tested were: (1) Parkes tool steel, 16c. per lb., 1 in. x $\frac{5}{8}$ in. section. (2) Parkes tool steel, 8c. per lb., 1 in. x $\frac{5}{8}$ in. section. (3) Firth tool steel, 15c. per lb., 1 in. x $\frac{5}{8}$ in. section.

Pieces about 15 in. long were obtained of the above, and from each piece two tools were made. One of these was tempered in the manner recommended by the maker, and the other by the Schenker process. The tools were all similar in design.

Manner of Making Tests.

All tests, except those made to compare hardness, were made on a lathe. The material used for turning was, in most tests, cast steel—an old roll and very hard.

Speed variation was effected by cone pulleys, consequently it was impossible to keep the cutting speed constant, as the diameter of the cast steel roll decreased. Every precaution, however, was taken to keep the cut, traverse and speed as uniform as possible in those tests which are comparable.

Results of Tests.

Firth Steel—Material tested, cast steel.	Tempered as per maker's instructions.	Tempered in Schenker process
Trial number	1	2
Depth of cut (inches)	1-8	1-8
Traverse "	0.0164	0.0164
Mean speed of cutting (ft. per min.)	38.5	35.5
Duration of trial (min.)	71	115
Amount of material removed (cu. in.)	67.2	160
Rate of removing material (cu. in. per hour)	56.8	52.5

The results of the tests of trials 1 and 2 are shown in the foregoing table.

In the above trials (1 and 2) both tools were used until they failed. The tools were then re-ground but not re-tempered, and tested with the following results. Trials 3 and 4:

Firth Steel Same tool as in trials 1 and 2 Re-ground but not re tempered. Material tested, cast steel.	Tempered as per maker's instructions.	Tempered in Schenker process
Trial number	3	4
Depth of cut (inches)	1-16	1-16
Traverse "	0.0164	0.0164
Mean speed of cutting (ft. per min.)	35	32
Duration of trial (min.)	85	108
Amount of material removed (cu. in.)	34.5	42.7
Rate of removing material (cu. in. per hour)	25.9	23.7

These trials show that the tool tempered by the Schenker process removed, in trials 1 and 2, 1.49 times, and in trials 3 and 4 1.24 times, as much material as was removed by the tool tempered according to the maker's instructions. Trials 5 and 6:

Parkes Steel—16c. per pound. Material tested cast steel.	Tempered as per maker's instructions.	Tempered in Schenker process
Trial number	5	6
Depth of cut (inches)	1-16	1-16
Traverse "	0.0164	0.0164
Mean speed of cutting (ft. per min.)	45	43
Duration of trial (min.)	64	170
Amount of material removed (cu. in.)	35.4	78.5
Rate of removing material (cu. in. per hour)	33.2	31.8

At the end of trial 5 the tool tempered in the manner recommended by the maker failed. At the end of trial 6 an attempt was made to run at a speed of 65 ft. per min., but tool failed.

Trials 7 and 8:

Parkes Steel—Same tools as used in trials 5 and 6. Re-ground, but not re-tempered Material tested, cast iron.	Tempered as per maker's instructions.	Tempered in Schenker process
Trial number	7	8
Depth of cut (inches)	1-8	1-8
Traverse "	0.017	0.017
Mean speed of cutting (ft. per min.)	60	60
Duration of trial (min.)	3.7	10.5
Amount of material removed (cu. in.)	5.56	16
Rate of removing material (cu. in. per hour)	91.8	91.8

These trials show that the tool tempered by the Schenker process removed, in trials 5 and 6, 2.22 times, and in trials 7 and 8 2.86 times as much material as was removed by the tool tempered in accordance with the maker's instructions. In trials 9 and 10 Parkes steel, eight cents per pound, was used. The tools, which had been previously used until they failed, were re-ground but not re-tempered. Trials 9 and 10:

Parkes Steel—8 cents per pound. Tools re-ground, but not re-tempered. Material used, cast steel.	Tempered as per maker's instructions.	Tempered in Schenker process
Trial number	9	10
Depth of cut (inches)	1-16	1-16
Traverse "	0.0164	0.0164
Mean speed of cutting (ft. per min.)	46	43
Duration of trial (min.)	6.1	33
Amount of material removed (cu. in.)	3.44	17-5
Rate of removing material (cu. in. per hour)	33 9	31.8

In trial 10 the speed at the beginning was 46 ft. per min., but as the diameter of the piece being turned decreased the speed, at the end of the trial was 40 ft. per min. These trials show that the tools tempered by the Schenker process removed 5.1 times as much material as the tool tempered in the ordinary manner. At the end of trials 9 and 10 both tools failed.

Hardness Tests.

Tests were made to compare the hardness of the different tools with the following results. The tests were made on a piece of tempered tool steel. Sample I, steel tempered as per maker's directions, failed to make any impression on the material. Sample II, air hardened, cut material slightly. No.I, tempered by the Schenker process, cut materials much more easily than did the No. II. The No. I tool, tempered by the Schenker process, was undoubtedly harder than the other tools. The tests for hardness were made on a shaper running at a very slow speed.

No cheating nor bargaining will ever get a single thing out of nature's "establishment" at half price. Do we want to be strong?—we must work. To be hungry?—we must starve. To be happy?—we must be kind. To be wise?—we must look and think.—Ruskin.

Producer Gas.*

By W. H. Ellis, M A., M B.

AMONG the competing fuels of to-day the gases play an important part, and the rapid growth of industrial enterprises in those districts where natural gas occurs may be adduced in support of this statement. In less favored regions, coal or oil gases which have large calorific values may be employed, but unfortunately their high cost has prevented any widespread use.

In general it may be said that only two varieties of this class of fuels are of importance for the production of power, viz., blast furnace gas and "producer" gas. The former, which results from the regular operation of the iron blast furnace, was formerly used simply for heating purposes, but it is now employed largely in driving the blowing engines; it is obvious that this gas is not available for the manufacturer at large, and hence it will not be further discussed in this paper.

"Producer" gas, which has become very important commercially, can be manufactured, on the other hand, in small or large quantities, and necessitates the use only of a small and compact plant. The methods of production vary according to the amounts of gas required, but the general process may be described as follows: Air, or air and steam, are passed through a red-hot body of fuel contained in a suitable brick-lined furnace, and the fuel and air are intentionally only half burned. This effect is favored (1) by using a thick bed of fuel; (2) by keeping the temperature below a certain limit (by varying the amount of steam) and (3) by supplying only enough air to allow partial combustion.

It will be here observed once more that this closely resembles very bad firing as sometimes conducted under power boilers. Indeed, the point has been well illustrated by the remark on a case of very bad firing, that the owner was running a gas producer and not burning the producer gas.

In the typical gas generator the process is usually continuous, fuel being fed in as needed, while the steam and air blasts are introduced simultaneously. Any class of fuel may be employed. If, however, a bituminous coal be selected it is necessary to introduce "scrubbers," etc., to thoroughly remove the dirt and tarry vapors. To obviate this necessity, coke and anthracite are much used in the smaller generators. The following are analyses of producer gases:

	From Anthracite.	From Bituminous Coal.	From Coke.	From Wood.
	p.c.	p.c.	p.c.	p.c.
Hydrogen	20.	10.	10.	20.97
Methane	....	3.	....	2.61
Ethylene	....	0 5	....	.28
Carbon monoxide	25.	23.	29.	13.27
Carbon dioxide	5.	5.	4.5	15.96
Nitrogen	49.5	58.	56.0	46.80
Oxygen	0.5	0.5	0.5	0.11
Calorific value (B.T.U.)	144	144	125	140

The apparatus in general use consists of two steel cylinders lined with fire brick, connected on the top and bottom with pipes, a fan for air, a boiler and gasometer. Fuel is charged at the top; air is blown in, also at the top, and comes into contact with the fresh fuel. The product of the partial combustion thus induced is the "producer" gas. Together with any tarry distillates, the gas is drawn downwards through the deep charge of incandescent fuel and out through the bottom of the producer. It then passes through the boiler, where its high temperature is utilized to generate the steam which is used for the blast, and is farther cooled to about atmospheric temperature in its passage through the water-sprayed, coke-filled trays of the "scrubber," whence it is led to the gasometer. When by means of regulating the amount of air admitted, the fuel bed has been raised to the desired temperature, the air blasts are discontinued. The valves are now adjusted so as to throw the two generators in series—in other words, so that the current will go upwards through the first generator, and thence downward through the second. Steam is at once admitted under the grate in one generator, and on its passage through the incandescent fuel is split up at the temperature of the fire, and, its elements combining with the carbon of the fuel, forms that mixture of gases known as "water gas." It then travels across the top connecting pipe to the steam generator and down through the latter, passing out from the bottom of this generator to the boiler, to the "scrubber" and thence to the gasometer. The

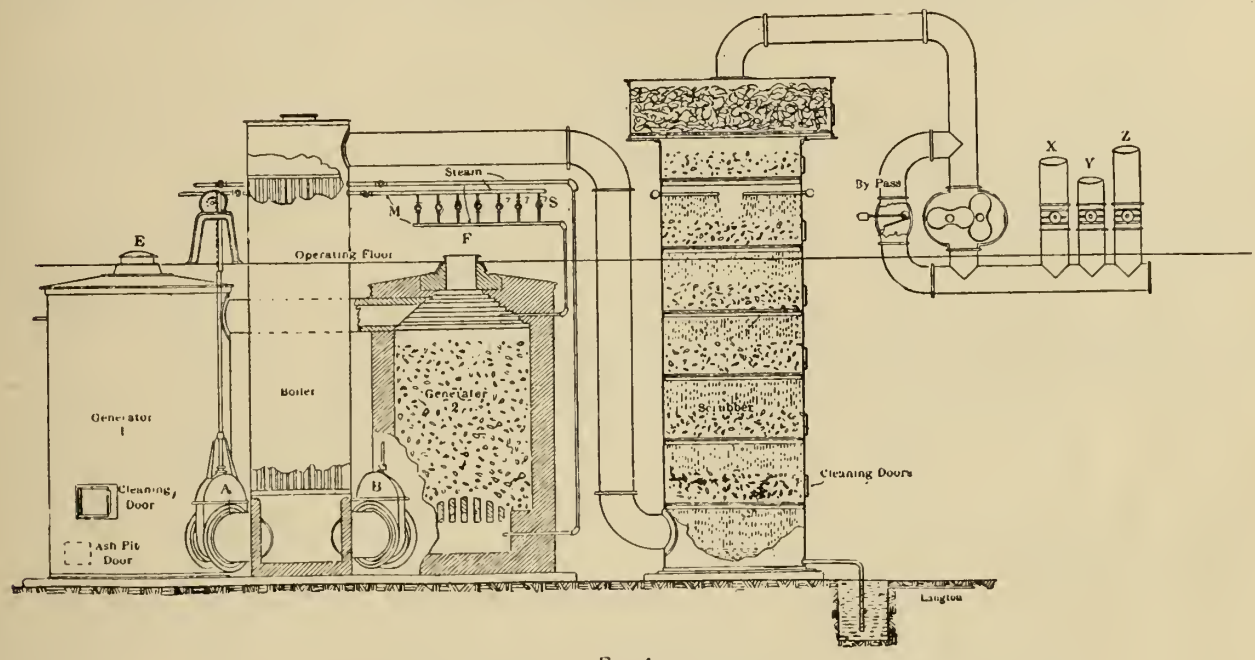


FIG. A.

* Read before the Canadian Section of the Society of Chemical Industry.

essential feature of this arrangement is that with bituminous coals, the tarry vapors liberated from the green fuel in one generator are forced through the hot fuel bed of the second, by which means they are completely gasified. The current of the steam is reversed at intervals. A good example of this type is illustrated in Figure "A"; it was erected by John Langton for the Montezuma Copper Company, Nacozari, Mexico, and has been running for five years in a very satisfactory manner, the fuel being wood.

In many of the smaller plants the fan for producing the air blast is dispensed with, and the suction induced by the piston of the gas engine is utilized for the introduction of air; no gas holder is here necessary. Generators of this type are known as "suction producers," and are very satisfactory.

When the amount of gas required exceeds that corresponding to, say, 5,000 horse-power, it is usual to instal apparatus for the recovery of the by-products. The best known system of this kind is the Mond, which has of recent years been used with great success. A 20,000 horse-power plant under continuous operation in England produced about 3,000 tons of sulphate of ammonia in a year; after deducting all expenses for operating, the profit on this amounted to nearly $1 per ton for fuel. The only Mond plant in America is at the works of the Solvay Process Company near Detroit, where a saving of fifty cents per ton of coal was effected with a daily consumption of 150 tons.

It may be asked why ordinary illuminating gas cannot be used for power purposes. The answer is that it is too dear. The explanation of the difference in price is a simple one. Disregarding minor factors, we may say that, in order to obtain a gas of sufficient illuminating power for house lighting, the distillation of coal is conducted in such a manner that only a portion of the coal is gasified. Immense quantities of coke, tar, etc., are left in the retorts and mains of gas works. In the case of producer gas, the conditions are such that the fuel may be entirely gasified. Gas producers therefore yield an immensely larger quantity of gas than ordinary gas retorts—the increase is, in fact, so very large as to make producer gas a cheap fuel, whereas coal gas is a dear one.

Progress of Modern Gas Engines

By C. Charles Maison, M.E.

Historical.

IN writing upon the subject of modern gas engines, it may be thought that a historical standpoint is out of place, but in reflecting at the progress made during the last 45 years it is remarkable how many of the improvements we are apt to regard as new are merely the embodiment of suggestions made by those engaged in bringing the gas engine into practical use to-day. Gunpowder, after its discovery, was sought after by early inventors to utilize its potential energy for their use as well as for destruction of their fellowmen. In consequence of this search many attempts were made to explode gunpowder in a cylinder as early as 1678, but owing to the mechanical difficulty to overcome in obtaining continuous and regular explosions with such a substance, its use was abolished. About the year 1792, however, Dr. Watson discovered that gas could be distilled from coal, and was experimented upon and demonstrated when again the subject of internal combustion was experimented upon. The first patent recorded, setting forth the use of explosive mixtures of coal gas and air in motors, was obtained by John Barber. He explained how a wheel, with vanes upon its circumference, may be driven by releasing the pressure of an explosion through an orifice placed in proximity to the vanes. It was just about this time the world-renowned James Watt brought about important development of the steam engine, which at that time was a source of powerful assistance in the mining industry, but the gas engine was undergoing much experiment, and another patent was obtained by Libon, setting forth the advantages of compressing the gas and air before entering the explosion cylinder. Therefore, two of the principles had been explained upon the merits of which later engines became a success.

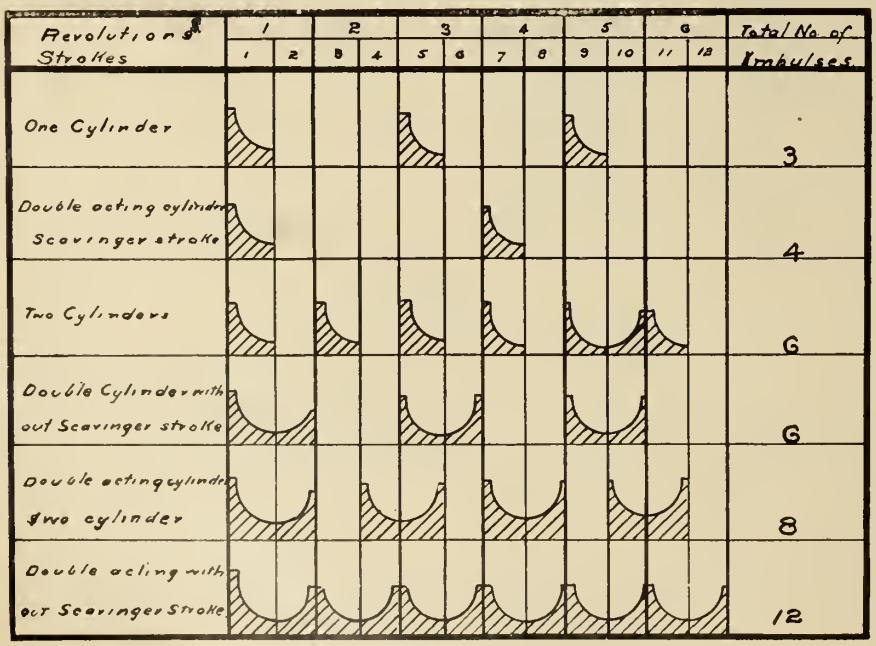


FIG 1

Action of Gas Engine.

There are numerous types of gas engines, and their comparative cycles is shown in Fig. 1, in which the shaded squares represent indicator diagrams taken from the back or front of the piston when an explosion takes place. It is seen that in a single cylinder engine, in six revolutions, only three impulses are given to the piston.

1st. Outstroke—Explosion and expansion.

2nd. Instroke—Products of combustion expelled.

3rd. Scavenger stroke, outstroke — Draws in air.

4th. Scavenger stroke, instroke — Clears cylinder.

5th. Outstroke—Draws in gas and air.

6th. Instroke—Compresses ready for explosion.

It is therefore evident that the back of the piston receives one impulse every three revolutions. Similiarly the front

of the piston receives one impulse every three revolutions, hence during the six revolutions two impulses are received by one side of the piston and two on the other.

Testing.

It is comparatively an easy task to test engines when specially fitted up for experimental work, and involves but little forethought from the experimenter. When, however, complete tests are to be made by the use of impromptu apparatus, there is ample scope for the ready exercise of one's wits in arranging simple and reliable means of measuring the quantities to be dealt with. In what follows we shall confine to gas engines, that is, not in conjunction with the machinery it may be driving. There are cases in which the work done by the driven machine is easily ascertained. For instance, the horse-power obtained from the terminals of a dynamo driven by a gas engine affords a measure of the useful work done, and, making allowance for the efficiency of the dynamo, gives the work transmitted from the engine flywheel to the dynamo pulley. But in every case the efficiency of the machine has to be allowed for, and as this

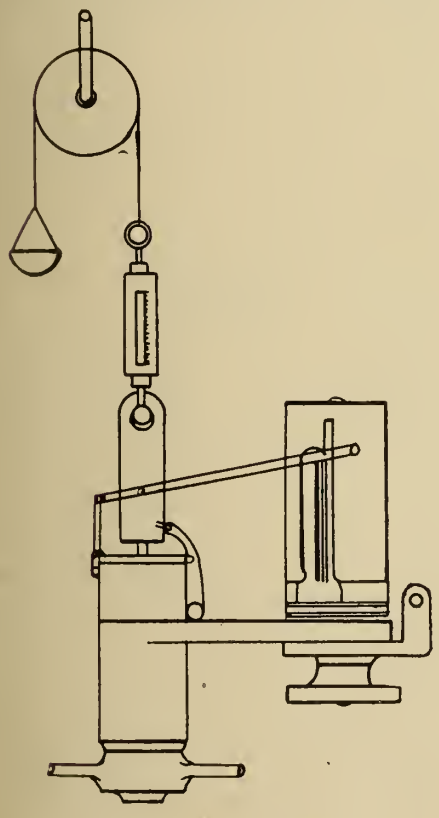


FIG 2

may be a rather uncertain quality, the only reliable method of testing is to run the engine separately, and to measure the power derived from the fly wheels by suitable means.

Indicating.

The diagrams obtained from gas engines cannot be relied upon, though they may, with careful manipulation and a suitable instrument, be considered accurate enough for practical purposes. Before any important trial is to be made the indicator springs should themselves be tested under the temperature and conditions likely to occur. The

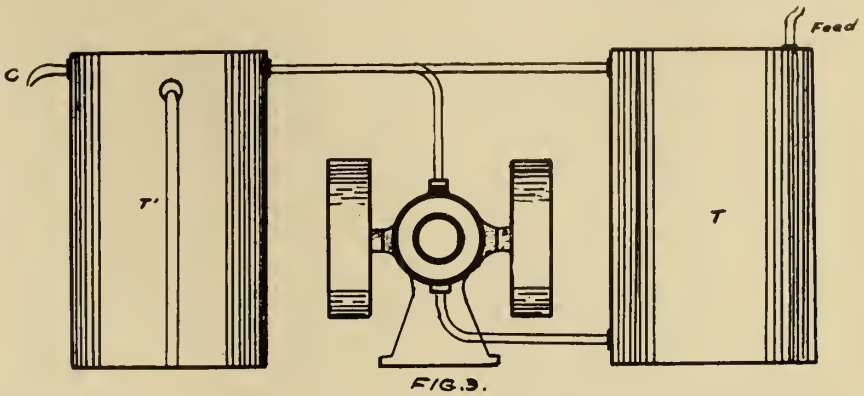


FIG. 3.

average difference in the deflections of indicator springs when hot and cold amounts to as much as 5 per cent., and more in some cases. A cold test is, therefore, no guarantee.

A simple method of testing the springs in the case of a gas engine is to construct a stirrup of brass, as shown in Fig. 2, it having a hole in it sufficiently large to allow the indicator piston rod to pass through it. This stirrup is placed in position by disconnecting the links attached to the pencil lever. Then obtain a 100-lb. spring balance, and carefully list it, with the stirrup attached against standard weights, noting the plus or minus errors, if any. Then pass the cord attached to the upper end of the balance over a suitable pulley, as shown. If a spring is being tested which is supposed to register 100 lbs. per square inch for every one inch vertical movement of the pencil on the drum, put the indicator on the engine and arrange the tackle above as shown. Start the engine, and whilst running slightly turn on the indicator cock so as to heat up the spring. When the indicator is at its working temperature close the indicator cock and mark off the atmospheric line on the drum, revolving the latter by hand. Then load the balance until it reads 10 lbs., and mark off the corresponding height of the indicator pencil. Proceed in like manner by increments of 10 lbs. at a time until the limit of the instrument is reached. Carefully measure the diameter of the indicator piston and obtain the area. For example, suppose our piston to be 0.5 square inch, and suppose when the balance reads 50 lbs. the movement of the pencil above the atmospheric line measures 1.03 in. The pressure per sq. inch at 1.03 in. rise

$$= 100 \times 1.03 \text{ lb per square inch.}$$

But the actual pressure upon an area of 0.5 square inch is 50 lbs., which is

$$\text{equivalent to } \frac{50}{0.5} = 100 \text{ lbs. per square inch.}$$

We see, therefore, that the indicator is recording a pressure 3 per cent. in excess of the real pressure acting upon the piston. When taking indicator diagrams from a gas engine it is advisable to keep the pencil upon the diagram paper for about half a minute, in order that a series of diagrams may be taken. If the engine is running at full power, the pencil will traverse the same path during each cycle and trace one distinct diagram. If, however, the engine is running lightly loaded, it is possible that it may not receive a full charge of gas, owing to the action of the governor, therefore the pencil will trace out a fresh diagram each time for each cycle.

The springs used for indicating gas engines are necessarily heavy, being

$$\text{from } \frac{1}{120} \text{ to } \frac{1}{250}.$$

Therefore only the compression, explosion and expansion curves are clearly shown upon the diagram. It is, nevertheless, important that the small variations in pressure during the exhaust and suction strokes should be ascertained as a check against bad valve setting and undue throttling in the pipes. To prevent the spring being subject to excessive compression during the explosion it is usual to pass a brass pipe $\frac{1}{2}$ inch in length over the indicator piston rod before adjusting the instrument for use. This arrangement will stop the spring from being crushed.

Special Considerations.

There are three important observations to be made with respect to the measurements of water jackets in gas engine trials :

1.—The quantity (measured in lbs.)

2.—The temperature of the inlet (measured in deg. Fahr.)

3.—The temperature of the outlet (measured in deg. Fahr.)

But the most convenient way of measuring the weight of jacket water depends so much upon local conditions

that no specific advice may be given. Fig. 3 shows such an arrangement which may be very interesting. Empty tank (T) by a syphon and plug the orifice of the upper circulating pipe leading into tank (T'). No circulation through the jacket is now possible without opening the feed cock (C). The feed water passing to tank (T') will pass through the jacket and find its way to tank (T). This tank may be calibrated to read pounds of water either by means of a float or by the insertion of a glass tube passing up the outside of the tank. The indicated horse-power of a gas engine is never a very certain quantity, yet it is calculated in trials. The inertia of the indicator levers, the effects of high temperature upon the indicator spring, and the difficulty in obtaining a true average from a number of diagrams when the engine is running below its full load, all contribute towards inaccuracy. For these reasons the ratio of a brake horse-power to indicated horse-power cannot always be relied upon as being correct, in consequence of which mechanical efficiencies of gas engines must be regarded with doubt, unless we have complete access to all the details of the test.

Figuring the Horse-Power.

The indicated horse-power, however, may be computed as follows, in which

I = the indicated horse power.

P = mean pressure per square inch upon the piston.

L = length of stroke in feet.

E = number of explosions per minute.

A = area of cylinder in square inches,

then we have $I = \frac{L E A P}{3300}$.

The most convenient way in working out a number of diagrams is to work out in decimal form the fraction $\frac{LA}{3300}$, and record this as the engine constant.

The factor we require to determine from the diagram is the mean pressure per square inch. Vertical measurements give pressures, and horizontal measurements distances, therefore the length of an ordinate measured with the scale of pressures gives the pressure per square inch at a particular point of the stroke. But if the pressure remained constant throughout the whole stroke, the diagram would become a rectangle, and the product of pressure and distance would give the work done. From this we prove that the length x breadth, or area of the diagram, represents to a scale the work done per stroke. The mean pressure, therefore, upon the piston may be found either by getting the average height of a set of equidistant ordinates, or by dividing the area of the diagram by the length, using instruments known as averagers. But to facilitate time, and most expeditious way, divide the diagram into ten equal vertical parts. Sub-divide each of these by a dotted line passing through their centres. It is required to find the height of these dotted lines. Take a strip of paper and mark off upon its edge the length of the first ordinate, then add to this the length of the second by applying the paper to the second ordinate. In this way the sum of the lengths of the ordinates may be obtained. Measure this with a rule. Suppose this gives us 5.08 in., we know that the average height will be 0.508 in.; but if the diagram is taken with a 100 spring, our mean pressure becomes 50.8 lb. per sq. in. Considering the difference between the gas and steam engine it is important that calculations should be dealt with independently.

The mechanical efficiency of a gas engine may reasonably be supposed to reach 80 per cent. This rating, however, is sometimes exceeded, in consequence of which it is better to underestimate, as no engine will develop its highest efficiency unless it is adjusted to perfection, and in the exigencies of modern practice this should not be relied on. But assuming 80 per cent. mechanical efficiency, we shall require a cylinder capable of developing $\frac{20}{0.8} = 25$ indicated horse-power.

Comparative Efficiencies.

While in steam engines the subject for consideration would be the maximum boiler pressure at our disposal, the very high thermal efficiency of the high-power gas engine and its practical application to supplying power in iron and steel plants have made it a strong competitor of the reciprocating steam engine, and have created a demand for this type of prime mover. To begin with, the efficiency of the gas engine exceeds that of the steam engine of either the single noncondensing, compound condensing or multiple cylinder types. In many cases the efficiency of gas engines has been based on indicated power developed in the working cylinders without deduction covering the power absorbed within the engine itself. Such quoted efficiencies are misleading, and without question the correct figures should be upon the effective brake horse-power. They should show the difference between the amount of heat actually consumed to deliver a given horse-power upon the crank shaft, as compared with the amount of heat which is theoretically equivalent to this same amount of power.

Assuming the thermal efficiency to equal 8,000 B.T.U. per brake horse-power where coal is used as a fuel, the consumption per effective horse-power would be for the same grade of fuel in direct proportion to heat consumption of the plant, and coal having a heat value of 13,500 B.T.U. per pound, the coal consumption for a plant operating say 3,000 hours per year, with 10 per cent. added to this for banking, would be over 11,000 pounds of coal per brake horse-power per year, with a steam engine plant having in use a simple noncondensing engine. There would be a consumption of 6,400 uounds of coal per brake horse-power per year with a steam engine plant using compound condensing engines, while with a gas engine plant where the gas is generated by a producer plant, the consumption would be 3,500 pounds of coal per brake horse-power per year, and this would be 75 per cent. saved by using a gas engine instead of using a simple non-condensing engine, and a gain of nearly 52 per cent. by using a gas engine instead of the compound condensing steam engine, there being a saving of 3,350 pounds per brake horse-power per year in the last named case, and 8,200 pounds per brake horse-power per year in the former case. Gas engines in general have passed the experimental stages, and rapid advancement of its use universally, both in plants, ships, and any place where power is required, and to effect a saving, even though the cost of a gas engine plant is greater than for steam engines of the same power.

UNITED STATES STEEL AND CANADA.

Despatches from New York and other places have been seen in Montreal which testify to the fact that some effort has been made—is being made—to sell the control of the Dominion Steel Co. to the United States Steel Corporation. Perhaps a confirmation of this may be forthcoming after the meeting of the directors of the American company, which was held in New York on April 24. Just prior to the annual meeting of the big American concern, which was held in Hoboken, N.J., on April 16, and just after it, too, there were meetings held in New York by interested parties, and that James J. Hill is no stranger to these negotiations is well known on the "inside." Then the fact stands out that the promoters of the sale are already in control of about 100,000 shares of the Dominion Steel common, and the addition of another 25,000 shares will make the deal feasible either as a merger or as a control. It is said by knowing ones in Montreal that this quantity of shares will be available in the open market when the time is ripe for the New York magnates to say the word "proceed."

Mechanical Reviews

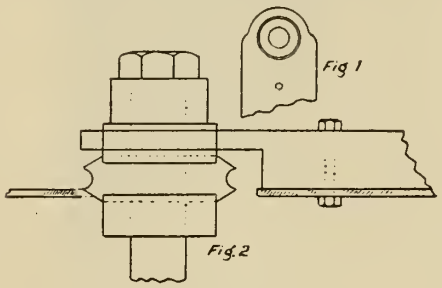
OPINIONS AND STUDIES WORTH NOTING

CARING FOR GASOLINE ENGINES.

COMPLAINTS regarding gasoline engines giving trouble are not always due to defects in the engines. In fact, we have found that 95 per cent. of such complaints were occasioned by the carelessness of the person in charge of the engine. We often receive letters saying that "My engine ran well and gave me no trouble for a year or two; but now I cannot get it to run." Usually we find in such cases that the appearance or condition of the engine indicates neglect and the only wonder is that the engine kept up so long. The great majority of persons who have trouble with the gasoline engine would have trouble in operating any kind of machine. They look upon anything that the engine might naturally require of them as trouble. Keeping the engine clean, oiling the engine, starting the engine, keeping it properly supplied with water, adjusting nuts and bearings when they need it, all are considered trouble and consequently are not done properly.

Contrast this class of operators with many from whom a complaint is never heard and you will find that the later makes it a pleasure and takes pride in doing the very things that the former regards as trouble. There never seems to be any trouble with his engine. Everything is trim and neat about his engine and engine room, and it always starts well and runs until he is through with it. The verdict of his less careful neighbor is that he has a much better engine than his own, which doesn't need his constant attention. The engines may be built just alike, even by the same manufacturer. The careless operator concludes that he has the worst one ever built, while his neighbor must have succeeded in getting the "best ever." If any difference, the careless operator may originally have had the best engine, but after a year's use it is no match for his neighbor's. His constantly grew worse during the year's use, while the engine of his neighbor apparently grew better. There may have been practically no difference originally in the construction and running quality of the two engines. But there is a wide difference in the management and care given the engines by the owners. The appearance of the engines indicates it. The one is literally covered with grease and dirt, is loose in its adjustments and runs with a wild and deafening clatter. While the other is "clean as a pin," even the roof under which it is located is clean and in order, all the adjustments are as they should be and the engine runs quietly and with such energy as to indicate that it is developing all the power it is rated.

Let us consider some of these details, which require from five to thirty minutes of someone's time every day before starting the engine. If the foundation bolts or nuts have worked loose it is necessary to take enough time to tighten them so that they serve their purpose. If an engine has a foundation at all it is well to keep it firmly secured, otherwise it will damage both foundation and itself. A good solid foundation, one on which the engine can be held firm at all times, is the only one to consider for a stationary engine. When an engine is running the nuts that hold the moving parts in position, such as the crank shaft, connecting rod, piston, valve lever, governors, spark mechanism, cam shafts, etc., will occasionally get loose and need tightening rod, piston, valve lever, governors, one's best judgment in adjusting these nuts. Take for instance the adjusting of the wrist boxes where the connecting rod joins on to the crank shaft. If the nuts holding these boxes are drawn the least bit too tight damage will quickly result, and if they are too loose bad results will follow. There is a happy medium which every gasoline engine owner and operator should acquaint himself with very soon after he takes charge of an engine.—The Blacksmith and Wheelwright.



SHAPING MACHINE DEVICE.

DEVICE FOR SHAPING MACHINE.

I GIVE herewith a sketch that is a convincing argument to any shaper hand that work can be done and yet avoid scratching from the shaper collars. I have used this for some time. Finished work fresh from the cabinetmakers can be shaped without any trouble. Our factory turns out a great deal of work on which it can be used, and all furniture factories have more or less of it. It is especially fine for swell drawer fronts, where a bead is shaped on the lower edge, or any work that is glued first and shaped afterwards to give the same margin.

Fig. 1 represents the ground plan. It is only a small board 20 inches long, 4 1-2 inches wide, and 1 1-4 inches thick. To begin with, take compasses and make a circle 1-8 inch longer than collars to be used. Then reset compasses to make another circle 5-16 inch longer than the first one, using, of course, the same centre. Then bandsaw outside circle half way and jig out inside circle, which must be done with care so as to have the same 5-16 inch margin at front, as shown in this figure.

Now we turn to Fig. 2, showing it set up ready for operation, bolted and clamped to the shaper bed. It is much better to bore a small hole, about half way back, using a small bolt and a thumbscrew at the end that will hold it firmly to the shaper top. Place cutters so as to set in, say, "just a hair," so that the points will just clear and make a perfect bead without leaving any flat place at top of shaping. Raise or lower the spindle as the situation may demand, so the bottom points of cutters will be in line with shaper tables.

These sketches will, I think, clearly illustrate what I have endeavored to explained.—C. O. P. in Wood-Worker.

SOME POINTS ON THE CARE OF AN ENGINE.

A STORY going the rounds of the daily newspapers tells of a number of mining promoters who were traveling through Mexico and at one of the stations one of the travelers got off the train and stood watching a Mexican mechanic who was going from car to car, "sounding" the wheels, presumably to test their condition. He was a fair type of a native "skilled workman." Just to draw him out a little, the American inquired of him why he tapped the wheels.

Setting down his torch, the man, staring in amazement, said: "Because the master mechanic tells me to."

"What good does it do?"

"I do not know, senor," said he. "The master mechanic tells me to strike each wheel, and I do so. That is enough for me."

"How long have you been working at this job?"

"Two years," he replied.

For two years he had been going through the form of sounding the car wheels, without the slightest knowledge of the object of the test or the slightest curiosity concerning it!

Had the story been told of a Yankee mechanic we might have thought that the mechanic was playing a trick on his interrogator, but, assuming that the Mexican was mentally of the capacity intimated, this story indicates an enormous lack of interest in his work.

Falls on Metapedia River, Quebec.

It is not unusual to find just such cases among operators of gas engines. If one happens to be around when a gas engine is being started by one of this class of help, he will often find that the engine fails to start. On trying again, or perhaps on several occasions, the engine will start, and, to the man who is at all of an inquiring mind, the question at once arises: "Why didn't the engine start the first time?" Perhaps the onlooker will make this inquiry of the engine operator, and many and many a time when I have done so, have I been answered, "Oh, I don't know. You can't ever tell what a gas engine is going to do."

Last Summer a party of pleasure hunters started out in a small motor boat for a trip. After being out a short time something happened to the engine, but they finally succeeded in making a landing and called on a man who was a gas engine expert to help them out. The host of the party was greatly embarrassed at the failure of his engine and offered to pay quite a liberal sum if the expert could get the engine fixed up quickly. After looking the engine over a short time he found the trouble was easily remedied. Here is what he told me of it:

"The old man was getting a little anxious and asked me if I thought I could fix it up. I told him I had never yet failed to get an engine going and I guessed I could get this one to run. 'I'll give you $5 if you get it to go in an hour,' said he. Well, I looked the engine over a little and finally I found the trouble was that a valve in the gasoline supply pipe had evidently gotten accidentally partially closed by some one brushing against it, and, of course, the engine did not get any fuel, or very little. When I showed them what the trouble was you can imagine their chagrin that they couldn't find it."

Now, the man who had that engine in charge had a mind much like the Mexican mechanic, unless he had just purchased the engine and it was new to him.

In another case a man spent a long time trying to start his engine and finally sent for an expert who found that his sole trouble was he had failed to throw in his battery switch and was therefore getting no spark.

Here is another incident which recently came to the writer's attention. A 45-H.P. gas engine was installed in a shoe factory and had been in use some time when the firm secured a man as an all-round machinist to take care of the shoe machinery, etc. Not long after he came he discovered that the gasket on the cylinder head was leaking and allowing water to get into the cylinder. He took off the head, and, on removing the gasket, found quite a number of gouges in the face of the cylinder. They looked to be marks of a cold chisel, and on making inquiry he discovered that the "shoemakers" formerly having the engine in charge had been in the habit of removing the asbestos gasket with the assistance of a chisel. They had not thought that it would make any difference in the head whether there were a few gouges in it or not, and the result was that it was only with difficulty that even the machinist could keep the joint water tight. To add to his difficulty, a water tank was placed on the second floor and the water from the jacket connected up to this tank. The pressure of the tank full of water at considerable height above the engine cylinder of course tended to increase the trouble.—The Gas Engine.

NEW FORGE-SHOP EQUIPMENTS.

Numerous large manufacturing establishments are awarding contracts for new forgeshop equipments to be installed during the Summer and similar equipments for manual training schools will be placed in many institutions during the vacation season. Many of the contracts are being obtained by the Buffalo Forge Co., which is at present busily engaged in manufacturing forge-shop equipments. Recent large orders obtained by the Buffalo Forge Co. have come from the Midvale Steel Co., of Pennsylvania, and from the Lynn works of the General Electric Co. Orders are also on file for the Calumet (Mich.) High and Manual Training School, and the Indiana Reformatory at Jeffersonville.

Practical Questions and Answers

Sparking of Electric Machines.

Ques.—What causes sparking at the brushes of an electric dynamo or motor ?

Ans.—If the dynamo or motor is running under constant load the only reasons there can be for sparking are :

(1) The brushes may not be set at the neutral points. If this is the only fault it can be remedied by moving the brushes while the machine is in motion until sparking ceases.

(2) The tension on the brushes may be too little or too great. In case it is too little the brushes will chatter and jump up from the commutator, and if there is too much tension fine particles of carbon will be worn off the brushes and will short circuit the commutator bars, causing sometimes a continuous line of sparks around the commutator.

(3) The commutator may be rough and in this case the commutator should be sand-papered while in motion, the brushes being lifted during the process.

(4) The brushes may be rough, and in this case the brushes should be sand-papered. This is done by inserting the paper between the brush and commutator, thus making the brush conform to the curve of the commutator.

(5) The commutator may be dirty, and in this case should be cleaned with rag or waste damped with a light oil.

Should the load upon the dynamo be varying, or should the load or speed of the motor be changing, sparking may result from improper design. For instance if in the dynamo the load be varied, the armature reaction will vary, and if the iron in the fields is not fairly well saturated, the resultant field will be greatly distorted, thus necessitating, for non-sparking, a change in the position of the brushes, so that they may be over the neutral points, for each change in load. In varying the field current of the motor to any great extent, as is done to secure large speed variation, the position of the resultant field is sure to be altered, causing sparking at the brushes. This fact has led to the originating of the interpole motor where very great speed variations are required in the motor itself. The interpoles counteract the action of the armature current upon the field.

* * *

Proportions of Shaft Couplings.

Ques.—Are there any definite formulae for the design of ordinary shaft pulley couplings ? If so, kindly give same. Or are there any standard dimensions for same ? If there are, kindly give a list of them.

J.W.R., Montreal.

Ans.—If by "shaft pulley couplings" J. W. R. means friction clutches for pulleys, then there are no definite formulae for their design, nor are there any standard proportions for them, except in so far as individual manufacturers may have developed them. The designs of pulley clutches are very varied, a great many of them being patented. However, if he means ordinary shaft couplings, the following may be of some use to him :

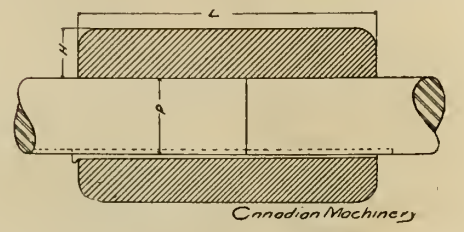


FIG. 1.—Muff or Box Coupling.

There are two distinct classes of shaft couplings, permanent couplings and disengaging couplings or clutches ; but it is probable that J. W. R. means permanent couplinas. Of permanent couplings there are several classes, depending upon the position of the shafts to be coupled together and upon the size of the shaft and the work to be done. Figures I and II are representative of the two nent couplings. Of permanent couplings for shafts in a straight line. Figure I is representative of the muff coupling, and Figure II of the flange coupling. The majority of the dimensions in each are purely emperical representing the best practice, while some are worked out from the amount of power transmitted.

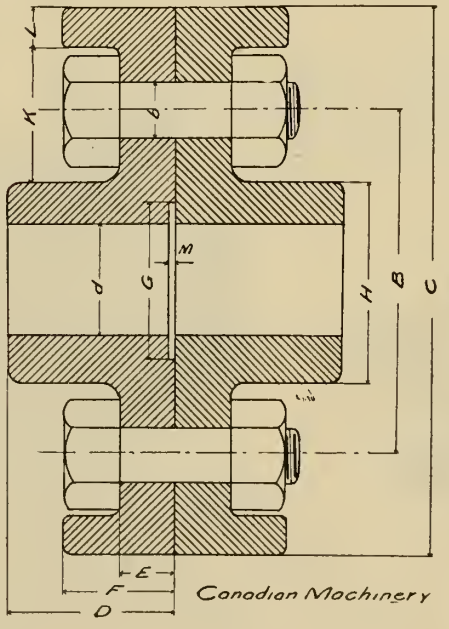


FIG. 2.—Flange Coupling.

Consider Fig. 1.

$L = 3\,d + 1\frac{1}{2}$,

$H = 0.45\,d + 0.225$.

The key is designed according to the size of the shaft.

Width of key —$b = 0.21\,d + 0.04$.

Mean thickness—$t = 0.12\,d + 0.04$.

Taper— 1 in 64 to 1 in 100.

Consider Fig. II.

N = No. of bolts = nearest whole number to $0.5\,d + 3$.

$H = 1.8\,d$.

$C = 3.4\,d + 1\frac{1}{2}$.

$D = 1.5\,d$.

$E = 0.25\,d + \frac{1}{4}$.

$F = 0.5\,d + \frac{1}{4}$.

$G = 1.4\,d$.

$B = 2.6\,d + \frac{1}{2}$.

$K = 0.7\,d + \frac{1}{2}$.

$L = 0.1\,d + \frac{1}{4}$.

M = 1/16 ins. for shafts of 1 in. diam. and less, and slightly more for larger shafts.

The diameter of the bolts used depends upon the power transmitted and upon the number of bolts.

Let b = diam. of bolt,

$T = \frac{\pi}{16} fsd^3$—as general formula for the stress in shaft is due to toque T. The shearing resistance of one bolt $= \frac{\pi}{4} b^2 fs$.

$\therefore$ " " in " n " bolts $= n \frac{\pi}{4} b^2\,fs$.

$$\text{Moment produced} = \frac{n \pi b^2 fs}{4} \times \frac{B}{2}$$

$$\therefore T = \frac{\pi}{16} fsd^3 = \frac{n \pi b^2 fs}{4} \times \frac{B}{2}$$

$$\therefore b^2 = \frac{d^3}{2 n B}$$

$$\therefore \text{and } b = \sqrt{\frac{d^3}{2 n B}}$$

But let $B = 2.8\,d$ (instead of $2.6d + \frac{1}{2}$)

$$\therefore b = \sqrt{\frac{d^3}{5.6\,nd}} = \sqrt{\frac{d^2}{5.6n}}$$

$$b = \frac{0.42\,d}{\sqrt{n}}$$

This gives the diameter of the bolts in terms of the number. In practice the diam. is increased slightly as :

$$b = \frac{0.42\,d}{\sqrt{n}} + 0.3$$

" n " is known and thus " b " is determined.

Each part of the coupling is keyed to its shaft, the dimensions of the keys being as given for Fig. I.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

COMBINED DRILL, CUTTER AND REAMER GRINDER.

A NEW grinder has just been placed on the market by Wilmarth & Morman Co., Grand Rapids, Mich., embodying new features, its use in grinding cutters and reamers being explained by the illustrations given.

The drill grinding features of this machine are such that each drill, on account of the peculiar relation between the axis on which it oscillates and the angularity of the V shaped trough in which it runs, determines its own position by its diameter and therefore there is no necessity for other adjustment for the diameter of the drill. The grinding of a drill is therefore a very simple matter and there is no temptation left for grinding drills by hand.

The cutter and reamer grinder is simple in construction, but as shown in the illustrations, is thoroughly practical for quite a variety of shapes and sizes. The larger straight and spiral milling cutters and shell reamers are supported on te main bar as shown in illustration No. 2.

Small milling cutters that have a smaller bore than the diameter of this bar can be supported on an arbor between the centres, which are shown supporting the taper reamer in Fig. 5.

Bevel cutters are supported on the swivel head on the carriage and this is adjustable to any angle. This same head is utilized for grinding the sides of side or face mills, as shown in Fig. 4.

Straight and taper reamers are ground as shown in Fig. 5, the centres being supported on the same swivel head that is used in grinding bevel or angle cutters.

The main bar on which the plain milling cutter in Fig. 2 is supported, is clamped in a bracket which supports all the cutter and reamer grinder parts and for this there are three slots provided in the base belt so that it can be adjusted to any position necessary to bring the varions cutters and reamers in the proper position in relation to the emery wheel.

The pulley on the drill grinding emery wheel spindle is 4 3-4 inches diameter, the one of the cutter grinder wheel spindle is 1 1-2 inches diameter for 1 inch belt.

RETURNED
JUN 5 190
To Ann
cut Book 51
page 26

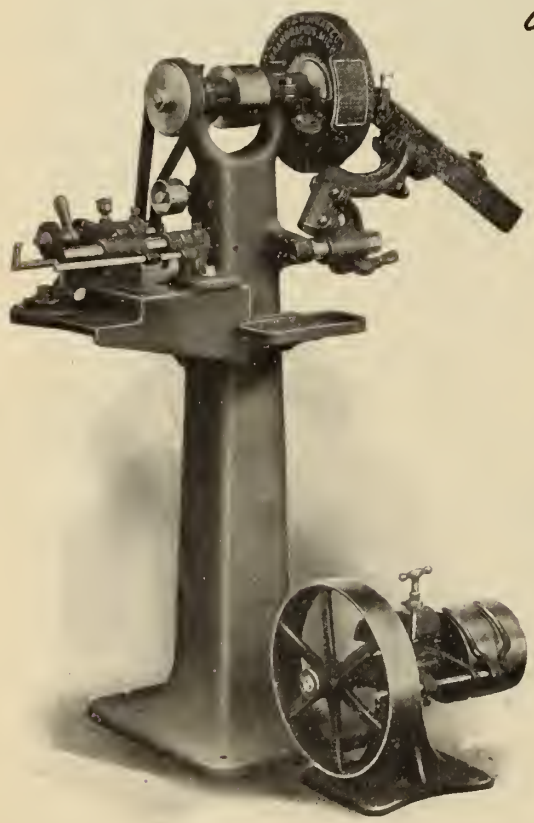


FIG. 1.—Wilmarth & Morman Grinding Machine.

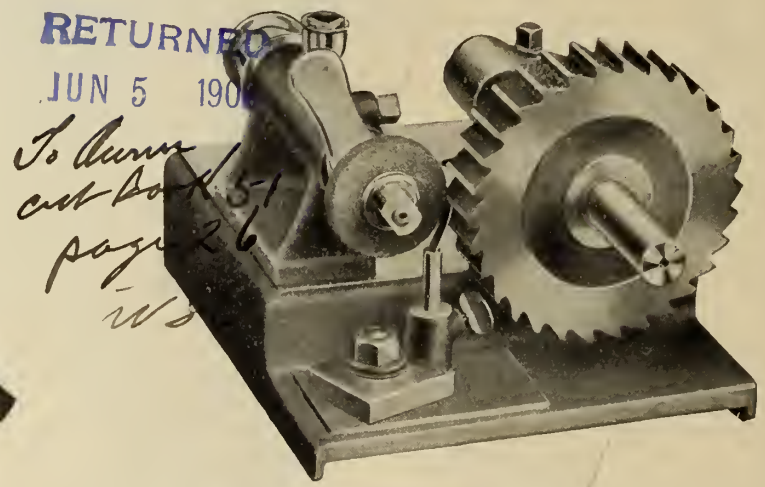


FIG. 2.—Grinding Milling Cutter.

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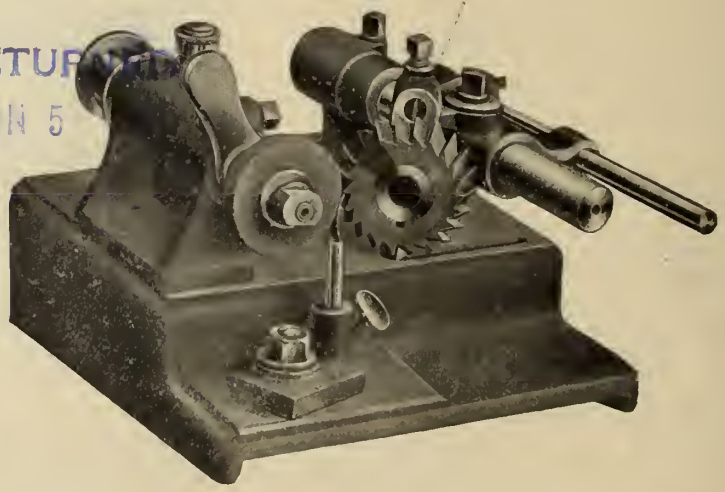

FIG. 3.—Grinding Bevel Cutter.

The cutter grinder spindle is hardened and ground and runs in an eccentric sleeve which is revolved by the handle shown to adjust the emery wheel to the cutter to be ground, this wheel being 2 1-2 inches diameter and 1-2 inch face.

"One point which this old, grey world has as yet failed to learn is that truth is infinitely better than falsehood."

SOME NEW TOOLS.

ILLUSTRATED herewith are three new lines brought out by L. S. Starrett Co., of Athol, Mass. The centre punch, for which a patent has been applied, is provided with knurled adjustable screw cap, which, working in connection with a spring, regulates the stroke. For work requiring a heavy mark, turn cap down; for work requiring a light mark, turn it up. To use it no hammer is needed. The punch being placed in an upright position over the working line, a downward pressure releases the striking block and makes the impression without danger of slipping, as is liable when a hammer is used. When adjusted for either a light or heavy stroke all indentations are of uniform size for starting the drill, etc., and accurate and quicker work can be done. The working parts are hardened, durable and accessible for such repairs as may ever be needed. The adjustable cap fits the hand, with no stroke adjusting screw through and above it to bother. The point can be ground without removing it. This punch, while small and light, is capable of giving a powerful stroke, thus taking the place of a heavier as well as a lighter punch. It is 1-2 inch in diameter. 5 inches long when adjusted for medium stroke and weighs but 3 ounces.

The draftsman's nickel-plated tea square is very light and accurate, the 18-inch weighing but 6 ounces. The head is struck up from sheet metal, the face of which is ground straight. The blade is spring tempered, .045 inches thick, 7-8 inch wide, and is riveted on top of the head so that the blade forms a bearing to guide a triangle, etc., back past the face of the head, not striking against it as would be the case if the blde was sunk into the head.

The blacksmiths' hook and handle rule is made from hard rolled sheet brass 1-10 inch thick, one 1-16 inch wide, with heavy graduations and figures, graduated from the end in 16ths of an inch on one side and from the inside of the hook in 16ths of an inch on the other, adapting them for taking correct measurements from either the outside edge of a hot piece of iron, or from the inside when held against a corner. They are graduated 12 inches, have flat handles and measure over all 16 3-4 inches.

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page 26
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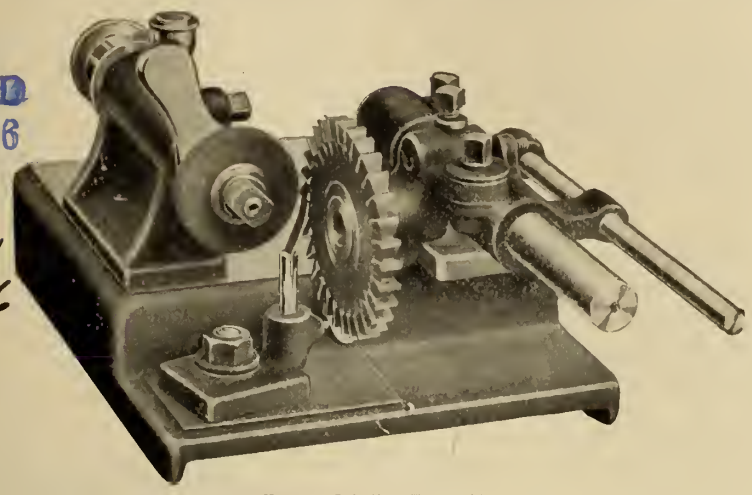
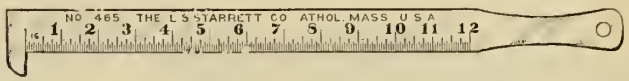
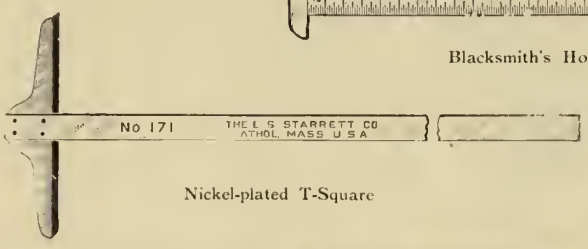


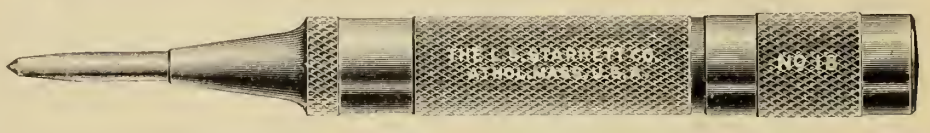
Fig. 1.—Grinding Face Mill



Blacksmith's Hook and Handle Rule.



Nickel-plated T-Square



Starrett's Automatic Centre Punch.

2 1-4 INCH TURRET MACHINE.

ONE of the machines used to good advantage in the plant described in a recent issue of Canadian Machinery is illustrated herewith, being one of the lines made by the Cleveland Automatic Machine Co.

RETURNED
JUN 5 1906

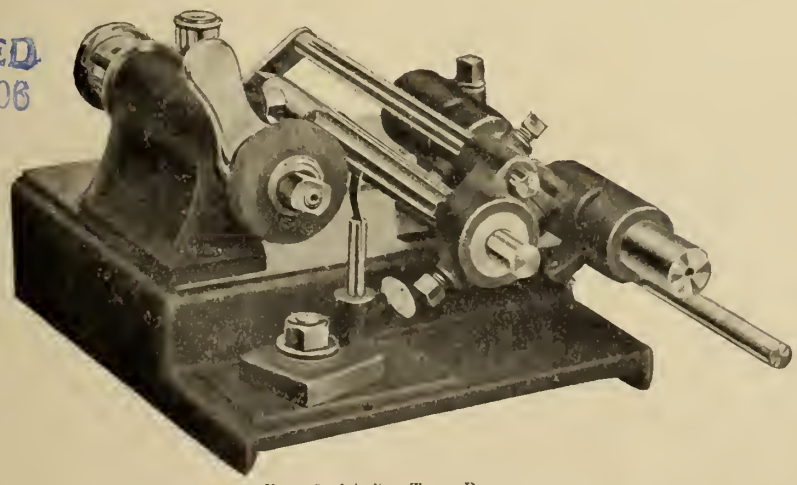
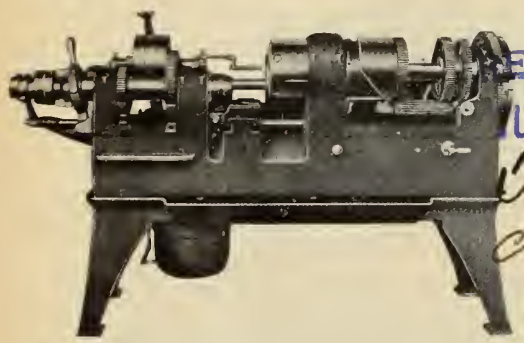


Fig.—5. Grinding Taper Reamer.

The rapid and independent adjustment of the feed of the tools is a very important feature. The operation is so simple that the feed of each tool may be changed without stopping the machine. In all other machines of this class, a change of speed—for the feed of the tools—is obtained in one of two ways: either by increasing or diminishing the speed of the feeding mechanism, and thus making a uniform change in the feed of all the tools in the series — the result in such ease is that but one tool has a proper feed; or the very expensive method of substituting cams for each movement. In our machines the feed of each tool can be adjusted independently and instantly, without removing any cams. This enables the operator to get the full cutting power of each tool. He can also change the work in a remarkably short time.

On all machines excepting those designed for light forming and brass work,

which are direct driven, we have no belt pulling on the spindle, but drive it by gears arranged on a shaft parallel to and behind it, so that a single belt running continuously in one direction will, when shifted from one pulley to the other, drive it alternately in opposite directions as is required in threading a screw and backing off the die. These gears may be, and usually are, so proportioned that the speed of the spindle is greater when running in one direction than the other. The advantage of this is made apparent when threading a long screw, as the die may be run off the screw at a much higher speed than is used in cutting the thread. Other operations and cutting off may also be run at the higher speed. By driving the spindle in this way we avoid the excessive wear caused by the pull of the belt, which has been found to be a source of serious trouble when the spindle is not so driven. The wear of the spindle being reduced to a minimum, the alignment of it with the tools is preserved indefinitely, which is a very valuable feature.



Cleveland Automatic Screw Machine.

The turret for carrying the tools is mounted on a shaft having an horizontal axis parallel with the spindle. The tools are inserted in the end. It is locked and indexed at its periphery, and as the tools are inserted in concentric order, and in a circle considerably smaller than that in which the locking is effected, they are held very rigidly in line with their work. The movement for reversing the spindle when threading or tapping is practically instantaneous. The full power of the belt is retained until the die or tap has finished its work. The cross-slide carries two tool posts, one or both of which may be used, as the operations may require. The tool posts on all machines are constructed for the use of circular forming and cutting off tools. When the character of the work requires, tool posts will be constructed for the use of flat tools. Circular tools can be ground on the cutting face without changing their form, and will therefore produce work of uniform shape until completely worn out. Convenient means are provided for the adjustment of tools.

quote:

EMERY GRINDER

A TYPE of emery grinder calculated to supply the need of the practical machinist is shown, being the product of the plant of D. McKenzie & Co., London. It is very heavy and stands 40¼ inches from the floor to centre of spindle. The bearings are 6 inches long, having a 1¼ inch mandrel. The rests swing on a round shaft. A special feature of the rest table is that it can be swung at any angle or can be used as a disc grinder for flat surfaces of planer knives, etc.

AN ANCIENT ENGINEERING FEAT.

DR. BERTHOLDT, of the University of Basle, has identified an ancient masterpiece of engineering in a tunnel built 2,500 years ago to bring spring water to a reservoir outside the gates of Jerusalem. The construction of this tunnel rivals that of the famous Simplon.

The tunnel leads into the pool of Siloam and is 360 yards long. Work was carried on from both ends, as is proven by an inscription in the tunnel and by marks on the boring tools used, showing the direction of the excavation.

What instruments were used 2,500 years ago for determining levels and directions, and how were errors detected ?—Modern Machinery.

SCARCITY OF ALUMINUM.

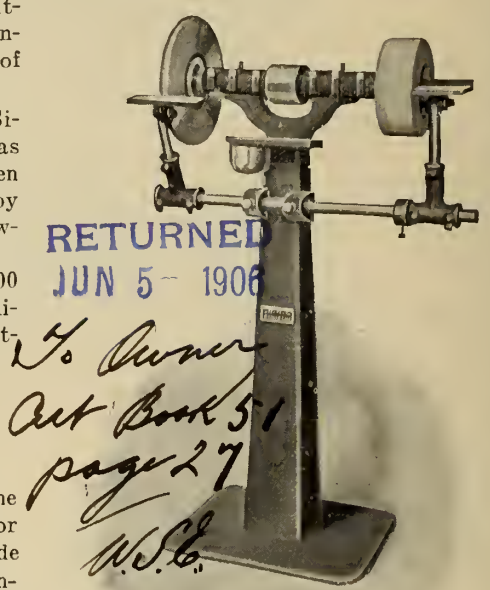
THESE are busy days in the aluminum industry, except for the manufacturers of goods made of aluminum, and if these concerns are idle or running on part time it is for the simple reason that they are unable to buy the metal at any price. The aluminum industry is growing so rapidly that the manufacturers of the article are absolutely unable to keep up with the demand. According to a New York exchange a New England manufacturer of aluminum novelties, who is entirely dependent for the progress of his business upon the supply of sheet aluminum, was unable in January to obtain promises of new stock earlier than June.

He endeavored to import the metal, but found this next to impossible, except at an almost prohibitory price. A few days ago when approached with an offer of a substantial order for novelties he was obliged to decline the order on the ground that it would be impossible to supply the goods at any stated time or at a price corresponding even approximately to his regular quotations. This manufacturer says :

"We have some foreign metal ordered conditionally for immediate use, but as we have to pay about 18 cents a pound more for it than for the local product we are not using any more of it than we are obliged to. We do not expect any aluminum from Pittsburg on our back orders before May, and we are obliged to run half time at present because we cannot get the stock."

Manufacturers of goods made of aluminum are displaying keen interest in the report that some one has discovered a new process of extracting aluminum, which will make the metal very much cheaper than formerly, and which will inject the spice of competition into the aluminum trade. It is reported that this new product is to be on the market in a few months.

The present manufacturers of aluminum are rapidly completing plans for



D. McKenzie Co. Grinder.

enormous extensions of their plants. Niagara Falls is one of the big headquarters of aluminum making in America, and the Pittsburg interests, at present predominant in the aluminum market, intend to erect at Niagara Falls the largest aluminum works in the world.

New uses for aluminum are discovered almost every day and the possibilities of the industry, if they may be judged by the progress of recent years, can hardly be calculated with any degree of accuracy. Whereas 50 years ago aluminum was known only as a curiosity found in a few laboratories, its present production in the United States alone amounts to something like 10,000,000 pounds a year. This country leads all others in its manufacture, and in the extent and variety of its uses.

BOOK REVIEWS

The Business of Contracting, by Ernest McCullough, M. West, Soc. Engineers, consulting engineers, Chicago; paper 45 pages; price, post paid, 50 cents. Chicago: Technical Book Agency.

Sound advice by a practical man is never amiss. The advice and information given in this book comes from a reliable source from a man who has had varied experience on the subject he is discussing and who is in every way qualified to speak with authority in the matter. The book itself is made up from a reprint from a series of articles in the Contractor. While in no way exhaustive it covers the ground in a fairly thorough manner. One particular virtue, and one which is too often lacking in books of this kind, is its conciseness. It discusses the staff, manager, superintendent and the foreman, in the first two chapters. Bidding on work is next dealt with in an able manner. Working methods are discussed. The book concludes with the office end of contracting and the importance of proper methods pointed out.

The Crystallization of Iron and Steel. An introduction to the study of metallography, by J. W. Mellor, D.Sc.; 144 pages; well illustrated; price, $1.60. New York: Longmans, Green & Co.

This book is a course of six lectures delivered to the engineering students of the Staffordshire County technical classes at the Newcastle High School, and summarizes the results of the more important researches made during the past ten years upon the constitution of alloys and steel. This subject is one which has only recently come into prominence and the far reaching importance of this knowledge is beginning to dawn upon the most conservative minds. The study of the subject is bringing to light the internal structure of the metals and their alloys. In the initial chapter the solidification and cooling of alloys is dealt with, after which the constituents of iron and steel are taken up. The hardening, annealing and tempering of steel is discussed in the next chapter, after which the author takes up the crystallization of iron and steel. The influence of stress and strain are demonstrated and their relation to the crystaline structure of the metal pointed out. The final chapter shows how to prepare a specimen for the microscope, as well as giving items of information regarding the instruments used. For those interested in the structure of metals and for metallurgists and students, this book is intended, and to such is a source of valuable information.

The Seven Follies of Science. A popular account of the most noted scientific impossibilities, by John Finn. 178 pages; illustrated; price, $1.25 net. New York: D. Van Nostrand Co.

Rather than a scientific dissertation, this book is a popular treatise on what is known as the seven follies of science, these being, squaring the circle, duplication of the cube, the trisection of an angle, perpetual motion, the transmutation of metals, the fixation of mercury, and the elixir of life. These are treated in an interesting manner with numerous historic references. Additional follies mentioned are, perpetual lamps, the universal solvent, palingenesy and the powder of sympathy. Following this is a small budget of paradoxes, illusions and marvels, making in all a fascinating collection of material that is of universal interest.

Extracts from Chordal's Letters, comprising selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the American Machinist, 11th edition, 396 pages, illustrated. New York: The Hill Publishing Co.

The style of these letters is extremely interesting and fascinating, containing as they do, much information on mechanical subjects, yet written in a manner that appeals to the reader at once. The whole trend of the letters is helpful. Methods in vogue in many places are shown up in a ridiculous light with a view no doubt to bringing about an improvement in existing conditions. While they are of prime interest to the machinist, anyone would enjoy their quaint style and quiet humor.

Gasoline Engine Ignition, by E. J. Williams; 91 pages, illustrated. Cincinnati: Gas Engine Publishing Co.

Not only is the subject matter of this book timely, but the appearance of the book when it is in a position to be appreciated should give an impetus to its sale and be the means of enlightening those interested upon a rather hidden and somewhat perplexing subject. The book is written from the author's observation in the marine gasoline engines field and being practical gives the reader pointers of no small value on the subject. The question is dealt with under the following heads: Magnetism, make and break ignition, jump spark ignition, batteries, generators, testing for trouble, kinks in power installations, horse power and wiring diagrams. The latter are of considerable value, since they show at a glance the methods of wiring of from one to four cylinders for both make and break and jump spark ignition.

Shaft Governors, by W. Trinks, M.E. and C. Housum; 97 pages, illustrated; price, 50 cents. New York: D. Van Nostrand Co.

The expression used as an introduction to the preface of this little book, "There are more forces in a shaft governor Horatio than are dreamt of in your philosophy," indicates the key note of the author's thought in dealing with the subject. Being men occupied in designing and adjusting engines and their parts, they are in a position to deal with the subject thoroughly. The matter is first dealt with from the theoretical standpoint. The centrifugal movement being calculated, as well as the mass of the valves reduced to centre of eccentric, and re-acting moment caused by friction of the valve reduced to theoretical value by formulae, the matter of friction is discussed and the different styles of governors described. A feature of this book is the neat diagrams appearing as inserts and which add a clearness to the subject matter that would not otherwise be obtainable.

The Indicator Handbook. A practical manual for engineers, by Chas. M. Pickworth, being Part I., taking up the construction and application of the indicator. Third edition, 130 pages. Manchester, Emmott & Co. Limited.

In this book engineers will find a practical treatise describing in a complete manner the indicator and its application, besides entering to some extent into the question of errors of the instrument. The reader is shown how to manipulate the instrument, so that if he be a beginner he is given an insight to make him take up the matter of indicating an engine with confidence. From the author's standing as an authority on such subjects, this book should meet with a good reception and no doubt those looking for information on the subject will seek to become conversant with its pages and diagrams.

ABOUT CATALOGUES

By mentioning Canadian Machinery to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

Dinkey Ventilated Controllers. A bulletin issued by the Electric Controller & Supply Co., Cleveland, O., describing in detail their controllers for various purposes.

Asbestos. An extensive report made to the mines branch of the Department of the Interior, by Fritz Cirkel, M.E., on the occurrence, explorations, and uses of asbestos. The report is profusely illustrated and contains a number of maps showing the location of deposits, etc.

Punching and Shearing Machines. A catalogue issued by Henry Pels & Co., 68 Broad street, New York, describing completely their patented punching, shearing and coping machines. It is well illustrated. Size, 11 x 8 inches.

Locomotive Cranes. A bulletin issued by the Wellman-Seaver-Morgan Co., Cleveland, O., describing and illustrating locomotive cranes and accessories. The bulletin is a very handsome one, 6 x 9 inches.

Type U Controllers. A catalogue issued by the Electric Controller & Supply Co., Cleveland, O., descriptive of their special type U controller.

The Sturtevant Economizer. Catalogue No. 130, issued by the B. F. Sturtevant Co., Boston, Mass. This well illustrated catalogue of 48 pages, 6 1-2 x 9 inches, is suggestive of the rapid progress made by the Sturtevant Co. in the illustration of the economizer, an important factor in economic steam generation. It contains a detailed description of the economizer, with statements of its advantages, instructions regarding installation, operation and repairs, a discussion of mechanical draft as an adjunct to the economizer and a series of valuable tables relating to the flow of air, efficiency of fuels, etc.

Form I. Motors and Generators. A bulletin issued by the Crocker-Wheeler Co., Ampere, N.J., containing a complete description with illustrations of of this style of machine. Size, 10 x 7 1-2 inches.

Monthly Stock List. The stock list of H. W. Petrie, Toronto and Montreal, of new and second-hand engines, boilers, steam appliances and other power equipment.

Electric Galvanizing. A bulletin issued by the United States Electro-Galvanizing Co., 1-9 Park avenue, Brooklyn, N.Y., describing their patented processes of electro-galvanizing. Size, 9 x 4 inches.

Map of Cobalt. The Canadian Fairbanks Co., Montreal, have gotten up a map of the district of Cobalt, which they will mail to any reader of Canadian Machinery upon application.

Mica. A report made by Fritz Cirkel, M.E., to the mines branch of the Department of the Interior upon the occurrence, exploration and uses of mica. It is illustrated. Size, 10 x 6 1-2 inches.

Pumps. A small catalogue issued by the Smart-Turner Machine Co., Limited, Hamilton, Ont., illustrating and describing their steam and power pumps. Size, 6 x 3 1-2 inches.

Engineering Books. The May list of engineering books published by Spon & Chamberlain, 123 Liberty street, New York.

Bolt Cutters. Bulletin No. 20, issued by the National Machinery Co., Tiffin, O., illustrating and describing their multiple spindle bolt cutters. The illustrations are exceptionally good. Size, $8\frac{1}{2}$ x $10\frac{1}{2}$ inches.

Something New in Motor Drives. A leaflet, sent out by the Gisholt Machine Co., Madison, Wis., showing two new methods of attaching motors to machine tools.

Cutting Off Machines. Catalogue No. 43, issued by the Newton Machine Tool Works, Philadelphia, describing and illustrating their cold saw cutting off machines. The typographical work is excellent. Size, 6 x 9 inches.

Gas and Gasoline Engines. Catalogue issued by the Toronto Gas & Gasoline Engine Co., Limited, Dufferin street, Toronto, illustrating and describing their stationary, portable and marine engines and motor launches. Size, 9 x 6 inches.

Oil Engines. A splendidly illustrated catalogue issued by Crossley Bros., Ltd., Openshaw, Manchester, England, descriptive of their patent oil engines. A general description of the engine is given, together with full page illustrations of the many types of engines. Size, 8 1-2 x 11 inches.

National Gas Engines. A 52 page catalogue issued by the National Gas Engine Co., Ltd., Wellington Road, Ashton-Under Lyme, England, describing and illustrating their gas and oil engines. This catalogue is exceptionally well illustrated. These engines are handled in Canada by the Economic Power, Light and Heat Supply Co., Ltd., 40 York street, Toronto, and the catalogue may be obtained from them upon application. Size, 6 x 9 inches.

Gas and Oil Engines. A circular issued by Crossley Bros., Ltd., Openshaw, Manchester, Eng., giving the particulars of recent tests made upon their engines. These results are of considerable interest to those interested in the economy of gas engines. Size, 8 x 10 inches.

Suction Gas Plants. A circular illustrating and describing the Pintsch suction gas plants, which are to be manufactured in Canada by the Economic Power, Light and Heat Supply Co., 40 York street, Toronto. This circular contains letters of recommendation from some of the users of these plants.

FOND MEMORIES.

After years of honest toil and ceaseless hard work, he had risen from obscurity and poverty to public recognition and affluence. Instead of going to a modest threepenny concert as he had been wont to do, by way of experiment he attended a grand Wagner concert, one of those gorgeous feasts of music where every instrument endeavors to drown the sound made by every other.

"Ah!" said a friend next day, "how you must have enjoyed that splendid Wagner concert I saw you at last night?"

"Ah, I did that! It took me back to the days of youth," replied the old man.

"Yes," said his friend enthusiastically; "to be sure. I understand. Those lovely Summer days in the sweet fresh country, when you went courting with the lasses in the hay-scented fields and lanes?"

"No, my friend. It took me back to the days when I worked in a boiler-shop!"

"There are in business three things necessary: Knowledge, Temper and Time."—Feltham.

Power and Transmission

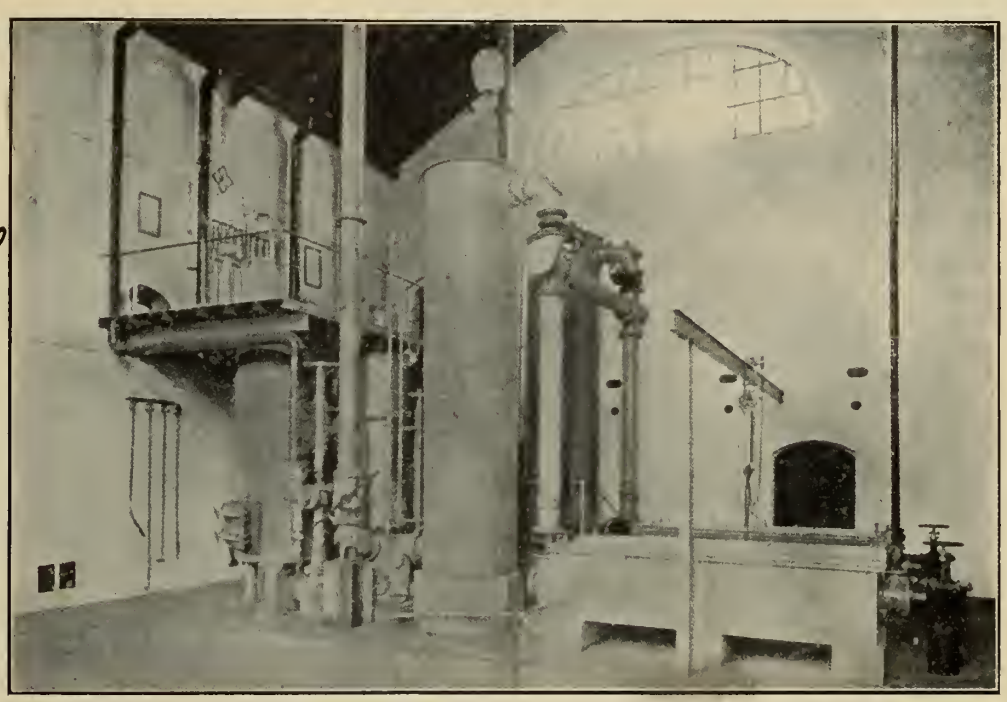
Steam Gas Electricity Compressed Air Water

PINTSCH SUCTION GAS PLANTS.

IN Canada the gas engine industry is now beginning to develop very quickly, especially in the producer gas line. Several years ago very little was heard in this country about the economy and other advantages of the producer gas plant for power purposes, but now much experimental work is being done upon these plants in Canada, and new firms are being started to manufacture these plants upon foreign patents, especially German and English.

The Economic Power, Light & Heat Supply Co., Toronto, are preparing to manufacture the Pintsch suction gas plants, a German type of producer gas plant, already in use all over the world.

RETURNED
JUN 1 1906
To Power
ent Book 5-0
page 91
Tw 86



The Pintsch Suction Gas Plant.—The Economic Power, Light and Heat Supply Co., Toronto.

This plant differs somewhat from the usual English and American suction plant, the ones with which the Canadian trade is most familiar. This plant consists of a producer, an evaporator, a seal and cleaning pot, a scrubber, a purifier and a governor. The action of this suction plant is briefly as follows: A mixture of air and steam is drawn by the suction stroke of the engine up through a bed of incandescent coal or coke in the producer, through the vaporizer, where part of the heat in the gas is utilized to vaporize water, through the water seal and cleaning pot and into the scrubber, where the gas is thoroughly cooled and partially cleaned, thence through the purifier, where all the fine dust is removed, and then through the governor to the engine.

The producer is a wrought iron cylinder, furnished with fire-brick lining and non-conducting filling. The vaporizer is separate from the producer, whereas in most plants it is situated around the top of the producer. The cleaning pot contains water and is situated directly under the scrubber. The scrubber is a wrought iron cylinder filled with coke which is sprayed with water, this spray being to cool the gas. The purifier is a vessel containing sawdust, where the gas is thoroughly purified and dried. A purifier of this kind is not used in any other gas plant. The governor is a patent arrangement for controlling the supply of gas to different sized engines drawing gas from the same plant. This also is something not contained in other gas plants. The advantage claimed for the separate vaporizer is that more heat is absorbed from the gas before it goes into the scrubber, and there is thus a saving in the amount of cooling water used in the scrubber. The supply of air is drawn from outside and is not heated before being drawn up through the producer, as is usual. In this way more oxygen per cubic foot of air is passed through the producer than if it were pre-heated. In sizes above 165 h.p. the plants are supplied with an air and steam mixture regulator. The producers are started in the usual way with a hand blower. When the engines are shut down the water seal is closed, thus holding a supply of good gas for the engine to start on when the plant is started up again. In starting the hand blower is used to force air up through the coal until sufficient steam has been generated to form the correct mixture, the generated gas being blown off until it is of standard quality, when the water seal is opened and the engines started.

Thousands of these plants, with a total capacity of 150,000 B.h.p. are now in operation. They have been built on sizes from 4 h.p. to 2,000 h.p. In the near future a plant is to be built in Canada for the manufacture of these gas plants. The Economic Power, Light & Heat Supply Co. will be able to supply engines in conjunction with

these plants, they being agents for the National Gas Engine Company, near Manchester, England. The firm will be pleased to receive any inquiries regarding these gas plants or engines.

THE CROSSLEY ENGINE AND GAS PRODUCER.

THE acknowledged method of increasing the efficiency of gas engines is to increase the compression and thus increase the ratio of expansion. The difficulty experienced in increasing the compression above the ordinary limits—about 110 pounds for ordinary coal gas and 180 pounds for producer, or blast-furnace gas—is that the higher temperatures resulting from any increase in compression are apt to cause premature explosions.

In view of this, a description of the new type of engine brought out by Crossley Bros., Openshaw, Manchester, Eng., in which the compression is carried to over 200 pounds per square inch, will be of interest. These engines which are illustrated in the three accompanying engravings, are operated upon producer gas, or coal gas, the producer-gas plant being shown in one of the illustrations. Premature ignition is prevented by drawing in a certain quantity of water during the suction stroke. One of these engines, an electric-lighting engine with extra heavy fly wheel, and engine cylinder 14 inches in diameter and 21-inch stroke, was tested recently by F. W. Burstall, professor of engineering, Birmingham University, and it gave a thermal efficiency of 37.4 per cent., the highest efficiency to his knowledge ever attained in a gas engine test. The calorific value of the coal gas used was 578 B.T.U. per cubic foot at atmospheric pressure, and 60 degrees F.; the cylinder volume was 1.872 cubic feet, the clearance volume 0.243 cubic feet, and the ratio of expansion 8.7; the maximum gauge pressure in the cylinder was 528 pounds, and the volume at the maximum temperature was 0.247 cubic feet; the average pressure during suction stroke was 12.8 pounds absolute; the compression curve was given by equation,

$$P V^{1.268} = 6,508 \text{ ft. pds.},$$

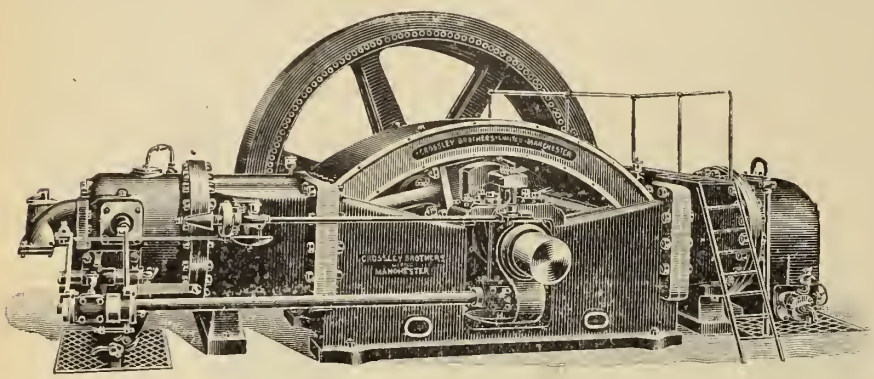
and the expansion curve by the equation,

$$P V^{1.183} = 17,610 \text{ ft. pds.}$$

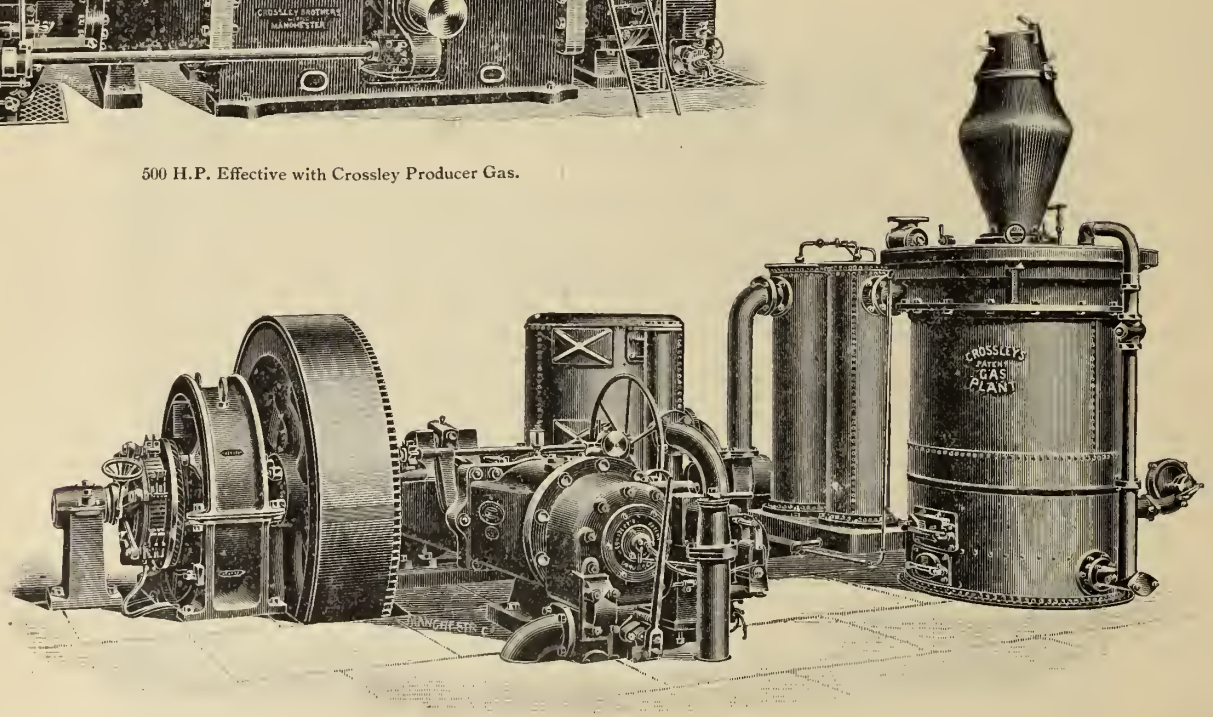
According to the report of the test, during the suction stroke the injected water appeared to turn into steam which became superheated during compression; heat passed into the charge from the walls until a pressure of about 160 pounds was reached, when there appeared to be equalization of heat; down the expansion curve the charge appeared to lose heat to the walls, at first rapidly, but towards the end the interchange was scarcely perceptible.

An important feature of the large Crossley producer-gas engines, above 500 H.P., is the equilibrium exhaust valve. One of the chief difficulties experienced in the manufacture of large gas engines is the operation of the exhaust valve. Owing to the largeness of the valve surface, the pressure upon it is very considerable; and, if the valve is operated in the usual method, i.e., by gear and worm operating the shaft keyed to the exhaust valve cam, there will be a very heavy load applied instantly to the gear and worm, having a deteriorating effect upon them. Crossley Bros. have overcome this difficulty by the use of a pilot valve close to main exhaust valve which is operated slightly before the large valve, and thus alows the gas from the compression space to press on the outside of large valve, thus making an equalized valve of it, and relieving the gear and worm of all great strain.

Crossley Bros., Limited, make both suction and pressure producer-gas plants for burning anthracite coal or coke, and they also make a plant for burning bituminous coal slack. The suction plant appears to have the greatest demand.



500 H.P. Effective with Crossley Producer Gas.



General View of Crossley Coke Gas Plant Engine and Dynamo.

TEST OF TORONTO WATERWORKS ENGINE.

VERY satisfactory indeed was the 24-hour test of the new triple expansion, three plunger steam pump at the Toronto Waterworks made recently under the supervision of Dr. Galbraith, Dean of the Faculty of Applied Science, University of Toronto. The test was arranged and conducted by Prof. R. W. Angus, B.A.Sc., assisted by the post-graduate year students.

The contractors for the pumping engine were the John Inglis Co., Ltd., Toronto, but it was built from designs made by the Allis-Chalmers Co., Milwaukee. At the test the contractors were represented by Mr. Lynch.

Results of Test.

According to the specifications the engine was to perform a duty of not less than 165,000,000 foot pounds for each 1,000 pounds of steam used. The results of the test show the engine to perform a duty well above this minimum limit. The chief results of the test are as follows:

Percentage of moisture in steam—1.22.

Average speed of plunger in feet per minute—197.90.

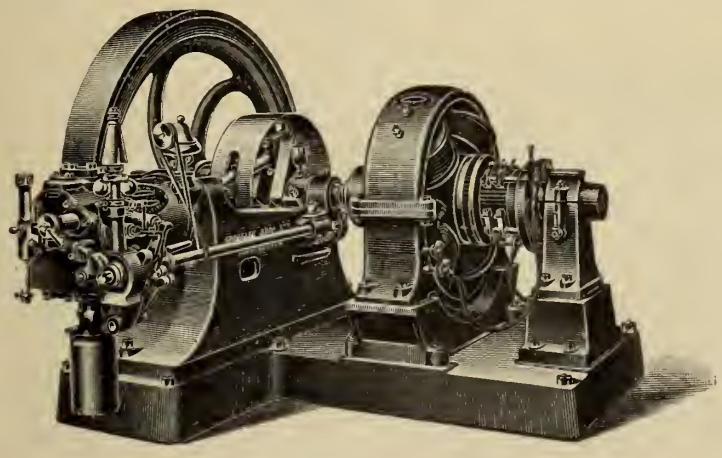
Discharge per 24 hours, Imperial gallons—15,104,031.

Duty per 1,000 pounds steam used, foot pounds—172,300,601.

A description of the manner of conducting a duty test on a large pump of this kind will probably be of interest to many readers of Canadian Machinery; but before the test is touched upon, a few facts regarding the construction of the engine must be given.

Description of Engine.

The engine is of the vertical triple expansion, condensing type, having three



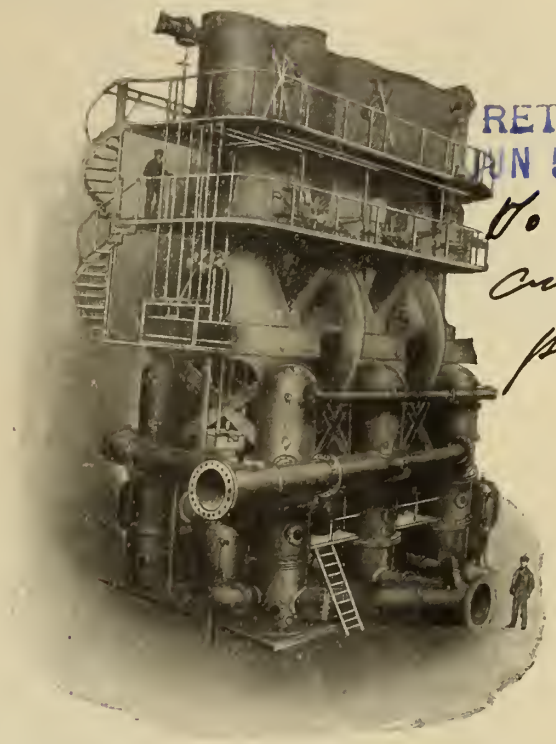
8-H P. Crossley Engine and Dynamo.

cylinders and three water plungers. The steam cylinders are respectively 32-in., 60-in., and 90-in. diameter, and 60-in. stroke. Each cylinder is steam-jacketed, the high-pressure jacket receiving steam from the main steam pipe. From the jacket the steam passes in successive stages through the reheating coil in the first receiver, through the jacket on the intermediate cylinder, the reheating coil in second receiver, through a trap into the low-pressure jacket and thence to the atmosphere. Drain pipes carry off the condensed steam from the receivers and steam pipes.

The main steam pipe is eight inches in diameter, branching to the upper and lower valves on high pressure cylinder. The main exhaust pipe is 20 inches in diameter.

The clearance in the cylinders is exceptionally small, the placing of the valves close to the inner face of the cylinder heads being one means of reducing the clearance. All the valves are Corliss valves with the exception of the exhaust valves on the low-pressure cylinder, which are poppet valves; these are opened by the valve gear, and closed by gravity and compressed air.

The engine is governed by a fly-ball governor, operating upon the cut-off in the high-pressure cylinder. The cut-off for the other two cylinders is regulated with hand wheels.



RETURNED
JUN 5- 1906
To Queens
Civil Book 5-1
page 28
WSL

Engine Toronto Waterworks, built by John Inglis Co., Toronto.

In starting the engine steam is admitted to the intermediate cylinder by means of a by-pass pipe from main steam pipe to the high-pressure exhaust pipe.

The pumps are single acting, and the plungers are outside packed. There are in all 1176 suction valves and the same number of discharge valves, each valve being 3 in. in diameter, and made of rubber.

The main suction pipe, 48 inches in diameter, is connected directly to the surface condenser.

The air pump, the feed pump and the compressor for compressing air to operate poppet-valves, are all attached to the low-pressure plunger.

The cranks of the engine are placed 120 degrees apart. Steam is supplied by a set of Heine boilers.

Manner of Conducting Test.

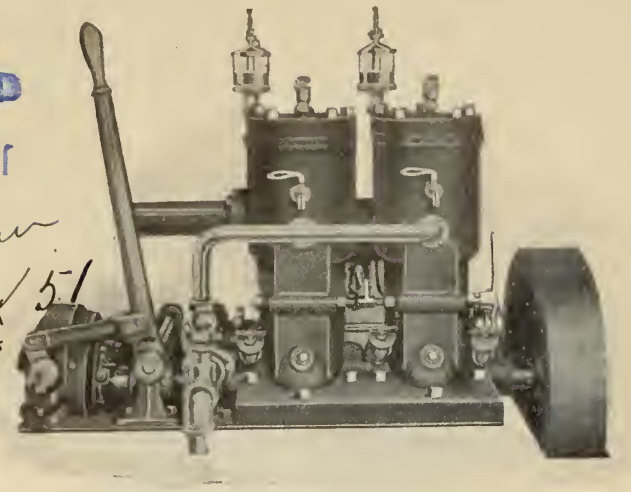
In the contract the character of the duty test was specified, and these specifications were followed. According to the specifications the engine must perform a duty of not less than 165,000,000 foot pounds per 1,000 pounds of commercially dry steam used, steam containing less than 1.5 per cent. water being recognized as commercially dry steam. In computing the duty the work done was to be computed from the plunger displacement, and from a head

representing the difference of head between a point in the discharge main beyond the last pump but inside the engine room, as shown by mercurial gauge, and a point in the supply conduit at the entrance to the pumps. In computing duty the total steam used, including that used in jackets, auxiliary pumps, etc., was to be charged to the engine. Now allowance was to be made for friction of water. The test was to be of 24 hours' duration, and the operation was to be continual against a head equal to 100 pounds pressure per square inch on the pumps. The steam pressure was to be 150 pounds per square inch.

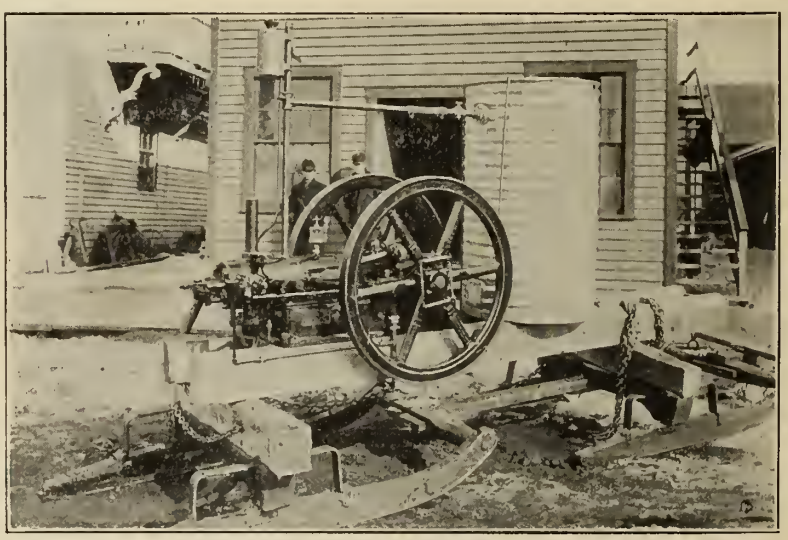
The amount of steam chargeable to the engine was determined by weighing the condensation from the condenser, the jackets, the reheaters, drain pipes, etc. The condensation ran into tanks placed on scales.

The average diameter of the plungers was found by calipering. The stroke of the plunger was found as follows: strips of oak 1 1-2 inches square were fitted tightly between points on the frame and made parallel with the piston rods; on these were fastened brackets and adjusting screws, the axes of the latter being parallel with the strips. These screws were so placed and adjusted that the lower one just touched the bottom of a pin on the cross-head at the bottom of the stroke, and the upper one touched the top of the same pin at the top of the stroke.

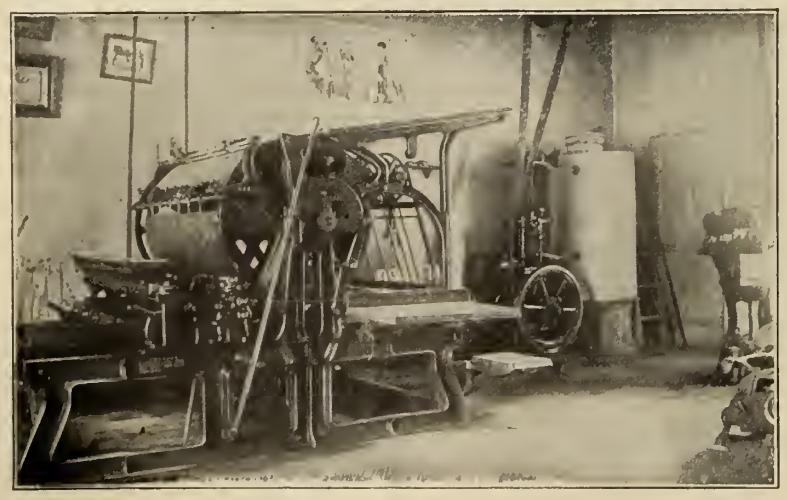
RETURNED
JUN 5 1906



Rochester Type, McLachlan Engine.



International Engine Mounted on Runners.



International Engine Running Press.

Summary.

Observations throughout the experiment were taken at twenty minute intervals.

From the calorimeter test the quality of the steam was obtained. From the number of revolutions, as shown by the counter, the average plunger speed in feet per minute was calculated. The amount of water pumped per 24 hours depends upon the plunger displacement per revolution, and upon the number of revolutions per 24 hours; thus the diameter of the plunger being known, and the length of the stroke, the water pumped can be calculated. Since the displacement per revolution is known, and the total head, represented as a pressure in pounds per square inch, the work done per revolution can be found, and thus the work per 24 hours. The steam used in the engine is represented by the total weight of the condensation. The duty of the engine is the number of foot pounds of work done per 1,000 pounds of steam, and from the foregoing this can be found.

The discharge pressure was determined with a Bourdon gauge instead of the mercurial gauge, while the suction pressure was determined with a manometer. The discharge pressure was kept fairly constant for purposes of the experiment by throttling the discharge main, and running an auxiliary engine when necessary.

The steam pressure was determined by Bourdon gauge, protected by a water column. The pressures in the receivers were taken from gauges on the gauge board, but were corrected for the water column between the receivers and the board.

The barometer reading was obtained from the Observatory in Toronto, but was corrected for difference of level.

The speed of the engine was taken from a revolution counter.

The quality of the steam, that is, the amount of moisture, was determined by a throttling calorimeter.

The temperature of the exhaust steam was taken in the exhaust pipe, and that of the condensation in the weighing tank.

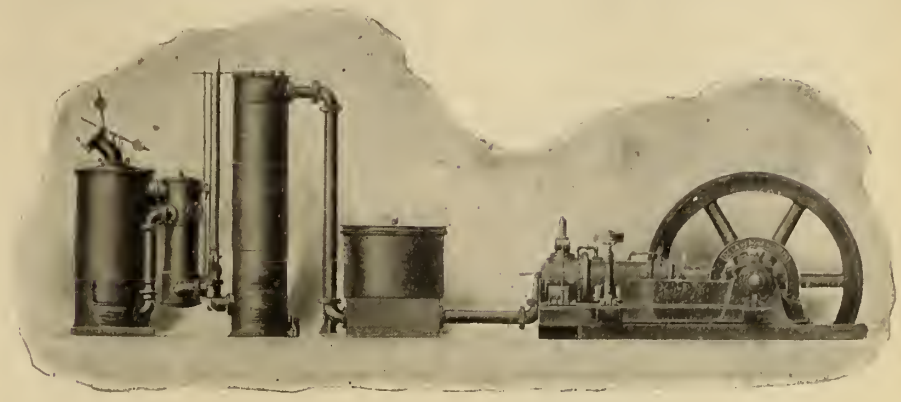
MAKING MARINE ENGINES.

THE McLachlan Gasoline Engine Co., Swansea, Toronto, who have up to the present been devoting their entire attention to gasoline traction engines and stationary engines, have now branched out into the manufacture of marine engines. The engine they are manufacturing is known as the Rochester type, shown in the accompanying engraving. These are high-speed, two cycle, three-port engines, built in units of 3 1-2 h.p. and up; they are also built with one or more cylinders.

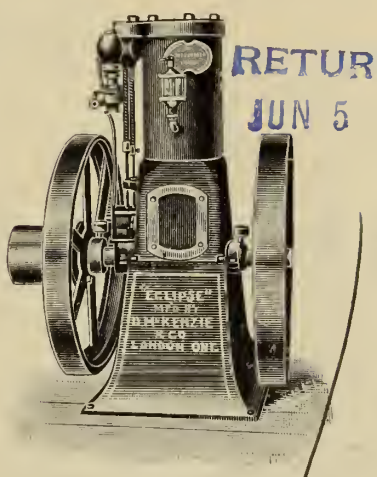
At the present time the company are putting considerable time on these engines, this being the beginning of the motor-boat season.

INTERNATIONAL GAS ENGINES.

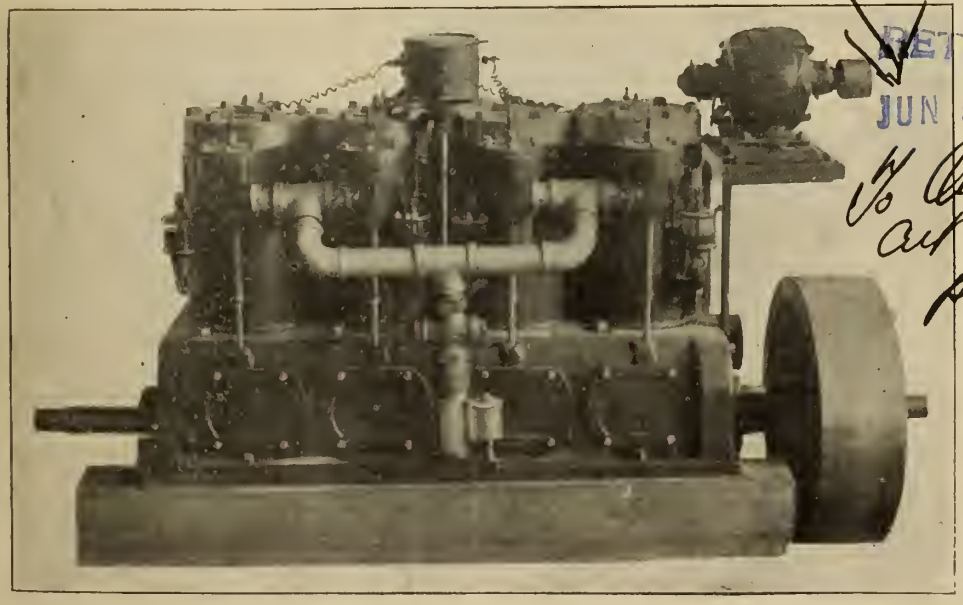
ONE of the most complete gas and gasoline engine catalogues issued is that published by the International Harvester Co. of America, Chicago. Two views of these engines are shown, one mounted on skids and the other one running a cylinder printing press. The catalogue describes in considerable detail their vertical gas and gasoline engines of 2, 3, 4, and 5 h.p., portable gasoline engines from 6 to 15 h.p., famous gasoline engines, 2 to 8 h.p., and famous pumping engines of 2 h.p., besides special attachments for these engines. Illustrations are given of various adaptations of the IHC engines, such as performing various operations around the farm, in printing offices, bakeries and plants of various kinds where a small amount of power is required. A post card addressed to the International Harvester Co. of America will bring one of these interesting catalogues, each one of which contains a large amount of information.



Koerting Suction Producer and Gas Engine.



Single Cylinder Eclipse Gasoline Engine.



D. McKenzie Co.'s Four-Cylinder Type, 40 H.P.

TWO LONDON ENGINES.

IN London, Ont., D. McKenzie & Co. manufacture two types of gasoline engines shown in illustrations; one of them is a heavy duty gasoline four-cylinder 40 h.p. engine made to meet the demand of the larger size of this type. The cylinder and cylinder caps are removable from the base, the design being such that the parts are easily accessible. The crank case is provided with large hand hole plates to get at the crank and connecting rod. Perfect lubrication at all speeds is insured by separate oil splash in the base for each throw of the crank. All valves are mechanically operated from the cam shaft.

The smaller engine shown is a 3 h.p. stationary of simple type and of easy operation, which the firm claim will operate on 1 pint of gasoline h.p. per hour.

SUCTION GAS PRODUCER.

IN the competition between steam and gas power, the suction gas producer and gas engine have become of the utmost importance on account of the fuel economy and simplicity of attendance. The advantages of the suction gas producer are well known in industrial circles, the result being a continuously increasing use of this system.

The producer gas is generated as follows: The suction of the engine draws a mixture of steam and air through the glowing fuel in the producer. The oxygen of the air forms with the carbon at the bottom part of the glowing fuel carbonic acid, which, by going upwards through the fuel, is reduced to carbon monoxide. Simultaneously the steam is decomposed into hydrogen and oxygen, the latter forming carbon monoxide by reaction with carbon. The resulting

horizontal gas and gasoline engines 4, 6, 8, 10, 12 and 15 h.p.

RETURNED JUN 5 1906

gas therefore consists mainly of carbon monoxide, nitrogen and hydrogen. The fuel to be used is anthracite, coke or charcoal. One pound of anthracite yields approximately seventy cubic feet of gas of 130 B.T.U. per cubic foot.

The principal parts of a suction gas producer plant are: (1) blower, (2) producer, (3) evaporator, (4) scrubbing apparatus, (5) pipes, valves and fittings. The blower is either a hand or a power blower, and is connected to the lowest part of the producer. The producer consists of a wrought iron shell, lined with fire bricks, and provided with ash and poke doors and a grate. The grate is kept cool by the steam of the evaporator. The producer is charged with coal through a bell hopper, which is of such size as not to require recharging of fuel too frequently. The steam and air enter the producer through a flange near the bottom and the gas leaves the producer through a flange near the top, giving off its heat to the evaporator after leaving the producer. The evaporator is a wrought iron cylinder filled with boiler tubes, which contains the water to be heated by the passing gas. The height of the water column is automatically regulated and the amount of entering air can be throttled. A three way valve is inserted between evaporator and scrubber which allows the gas to be cut off the scrubber and passed out to the flue or vice versa. The scrubber is a wrought iron tank containing water in its lower part. The upper part is filled with coke which is continuously sprayed by a rain of finely divided water. The sawdust scrubber, in which the gas is filtered, contains two or more gratings covered with shavings and sawdust.

In an engine of the four-cycle horizontal type during the first stroke the gas mixture is drawn in, during the second stroke the gas mixture is compressed, during the third stroke the gas mixture is exploded and expanded (working stroke), during the fourth stroke the burnt gas is exhausted.

The formation of the combustible mixture takes place in the mixing valve. At the suction stroke the gas and air openings of this valve always open in the same proportion. The mixture is therefore always constant and uniform, independently of speed and load. The size of the openings of the mixing valve varies according to the kind of gas to be used. Our engines have on account of this mixing valve the great advantage of easy and quick starting, and automatic and economical work.

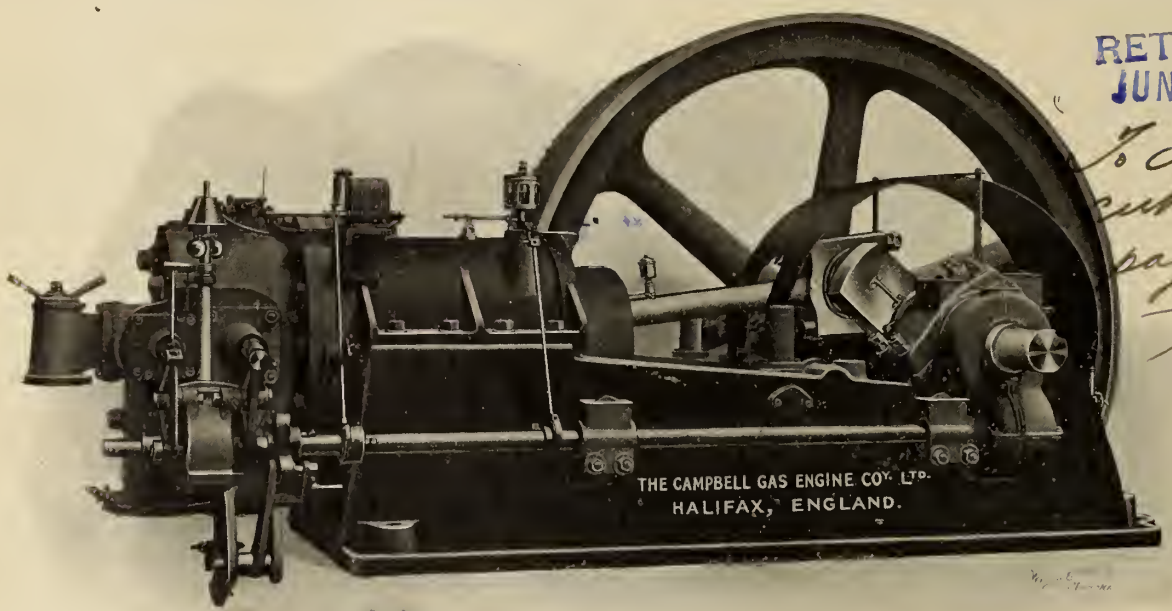
In large engines of the Koerting type, as manufactured by De La Vergne Machine Co., New York, the combustion space gets very large as compared to the cooling area whereby the heat of compression is considerably increased, causing insufficient cooling and danger of preignition, which would interfere with the uniform running of the engine. For preventing this defect, the cooling area is increased by connecting a water-cooled projection (offset) to the cover at the back end of the valve head. Another advantage of the Koerting engines is the removable cover of the cylinder which allows inspection and cleaning of the valve head and cylinder without removing the piston.

A 75 h.p. suction gas power plant driving electric generator on a coal consumption of 1½ lbs. per k.w. hour can be seen in the shops of the De La Vergne Co.

A 60-H.P. CAMPBELL GAS PLANT.

AN illustration of an engine installed in the factory of the Simonds Canada Company, Limited, Montreal, which has been in operation for about five months is here given. This plant and engine is used for driving heavy grinding machinery used by the Simonds Company in turning out the large circular and band saws which form an important part of their product. The full load of the engine is required practically the whole of the day and is obtained at a fuel cost of nine cents per hour. In addition to furnishing gas for the engine the plant is also supplying gas for other purposes in the factory. The proprietors express themselves as pleased with the satisfactory performance of the plant. The gas plant is exceedingly simple and occupies very little floor space. The operation of cleaning and charging occupies comparatively little time. The engine is of 50 h.p. ordinary type single cylinder, and is of very massive construction throughout. The ignition is effected by an oscillating magneto of new design, which gives positive ignition at all speeds. The governing is so arranged that changes of speeds can be effected whilst the engine is at work. The governor controls automatically the supply of gas to the engine and also the quantity of gas made in the generator.

This plant was installed by Wayland, Williams & Dadson, Montreal, who have also made installations at Woodburn, Sons Co., Limited, Montreal, of a 25 h.p. engine and plant operating the factory, and also doing the electric lighting of the premises. Another installation of same size operates the factory



RETURNED
JUN 4 - 1906
To Montreal
cut Book 5-1
page 16
W.L.E.

The Campbell Gas Engine.—Wayland Williams & Dadson, Montreal.

of the Ryall Screw & Specialty Company, Montreal, also Beauvais Frere, Laprairie.

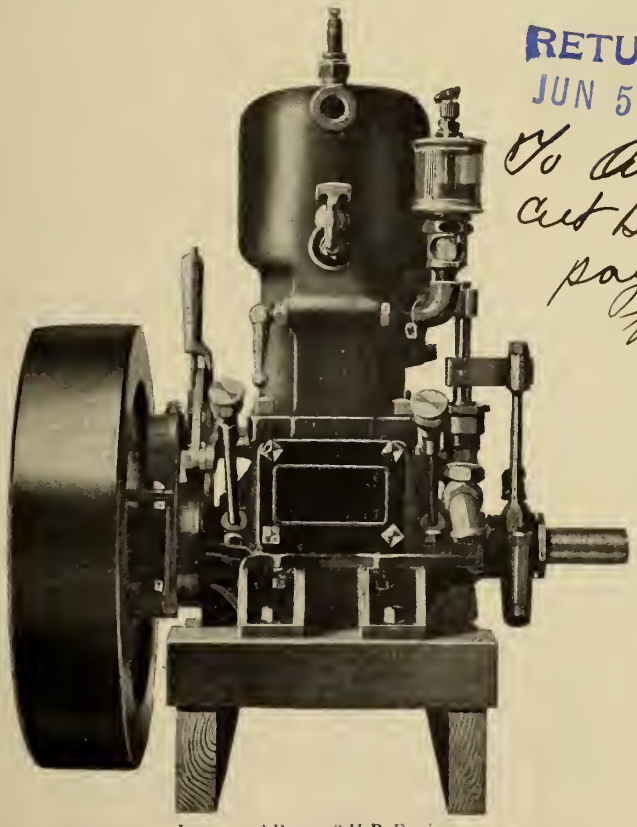
LETSON & BURPEE ENGINES.

AMONG the newer firms in Canada is Letson & Burpee, of Vancouver, who have lately gone into the manufacture of gasoline engines. They have lately equipped a modern working plant with the best machinery on the market, and are prepared to go into the manufacture of these to considerable extent. An illustration is shown of the port side of a 3 h.p. engine. Some of the features of this engine include the cylinder and head being cast in one piece, thus avoiding any high pressure joints in the cylinder head. The water jacket covers the head as well as the wall of the cylinder and gives ample cooling surface. The cylinders are made of a grade of iron selected for the purpose and are carefully bored and reamed to size, insuring uniformity, accuracy and smoothness of bore.

In order to get proper compression of the charge in the cylinder it is important that the piston rings be right. The rings in this engine are split so that each half of the joint laps the other when compressed. They are turned after being compressed, and are crescent shaped, being thickest exactly opposite the split. This insures a perfectly fitting and evenly wearing ring.

The connecting rod is made of steel and an I cross section. Both ends are bored large and bushed with phosphur bronze, provision being made for taking up the wear on both sides.

The crankshafts are of the best machinery steel, forged from the solid bar. The crank pin and main bearings are of good length, which insures long life of the wearing parts. The crankshaft for the single cylinder engine is provided with counterweights which perfectly balance the piston and connecting rod. In the larger engines these parts balance each other. The thrust is taken by a ball thrust bearing.



Letson and Burpee 3-H.P. Engine.

RETURNED
JUN 5 1906
Do Annex
Cat Book 57
page 90
W56

NEW ONTARIO COAL.

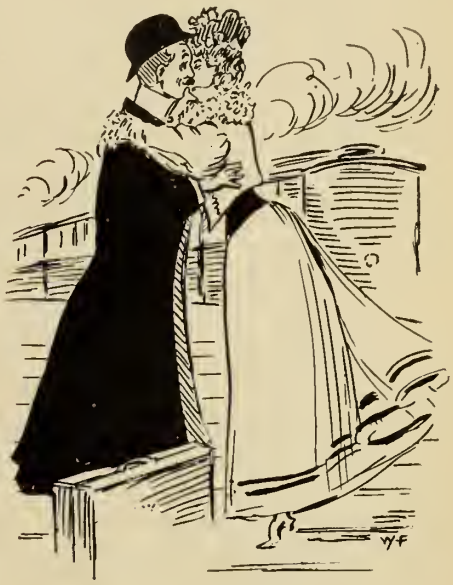
The announcement made by Hon. Frank Cochrane that anthracite coal had been found in Northern Ontario is of great importance to the province, as the industrial importance of coal to the country cannot be over-estimated. At present Canada's coal supply lies in the extreme east and the extreme west, hence the discovery of coal in Ontario, and hard coal at that, is a thing that means a lot for Central Canada. Until further evidence is produced, however, this discovery should not be too quickly taken for granted, for the same reports were circulated some few years ago, when hard coal was supposed to be found at Sudbury. A company was floated to develop these mines, but it was found that their find consisted simply of a material called anthraxolite, which is not at all valuable as a fuel.

AT THE NOON HOUR

Electrical Impulses.

Things would have been different if electricity had lighted the station, but our poet just adores gas, hence the following effusion :

I waited for the railway train,
The gas was low and dim ;
It came at last, and from the car



Electric Impulse.

There stepped a dainty dame,
And looking up and down the place,
She straight upon me came.
"Oh Jack !" she cried, "oh, dear old Jack !"
And kissed me as she spake ;
Then looked again, and frightened cried :
"Oh, what a bad mistake !"
I said, "Forgive me, maiden fair,
For I am not your Jack ;
And as regards the kiss you gave,
I'll straightway give it back."
Since that night I've often stood
Upon that platform dim,
But only once in a man's whole life
Do such things come to him.

—Electrical Magazine.

A Pi Line That Made Trouble.

The copy was illegible and the linotype man slammed in a pi line so that the proofreader would decipher the manuscript of the account of the wedding and make necessary corrections. For some reason this was not done, which is why the next day a determined looking young man with "bridegroom" stamped all over him and a tearful young woman who still had rice in her hat appeared at the office and demanded an explanation of a paragraph that read :

"Then down the aisle came the bride, who looked like ffipouxthnbgfdertyhnb."
—Ex.

Companies Incorporated

Hudson Bay Extended, Limited, share capital $50,000, to carry on mining business. The directors, J. W. McDonald, E. A. Francis and M. A. McKessock; head office, Toronto.

Camugay Tramway Co., incorporated under Dominion charter; capital stock, $200,000; to construct and maintain tramways in the City of Camugay, in the Island of Cuba; chief place of business to be Halifax.

The Laurentian Mfg. Co., Montreal; capital stock, $20,000; purpose, to manufacture and deal in woodenware. Directors are: Thomas Pearson, Geo. Pearson, W. F. Sawyer and E. P. Sawyer, all of Montreal.

The powers of the Dominion Pressed Steel Co. have been extended to manufacture and deal in all articles capable of being made from pressed steel, and to manufacture and deal in wooden handles, bales, etc.

The Cobalt Standard Mining Exchange, Limited, have been incorporated under provincial charter; share capital, $40,000. Directors, J. W. McDonald, H. L. Dunn, A. Blackman, E. Francis; head office, Town of Cobalt.

The Rapid Tool Co., Limited, $40.000 share capital, have been incorporated under provincial charter for the purpose of dealing in tools and hardware. Directors to be W. Rudins, W. Quinn and G. L. Hay, with head office at Peterboro.

The Roofers' Supply Co., Limited, incorporated under provincial charter to deal in roofers' supplies and structural material, with a share capital of $200,000. Directors, A. Dods, R. B. Rennie, G. Duthie, A. Mathews; head office, Toronto.

Coopers Ltd., Montreal; capital stock, $2,000,000; purpose, to deal in and develop mines of all kinds. Directors are: R. P. Inglis, Geo. Boulter, W. H. C. Mussen and F. H. Mackey, all of Montreal; Jas. Playfair, Midland; and Wm. Inglis, Toronto.

The Cobalt Chartered Co. have been incorporated under Ontario charter, share capital $350,000, to carry on mining and development. Directors, F. Law, A. Lebeau, E. E. Belcourt, J. N. Rattey, H. Letorneau; head office, Haileybury, Ont.

G. Duthie & Sons have been incorporated under Ontario charter with a share capital of $40,000, to carry on the business of roofers and sheet metal workers. The provisional directors are: George Duthie, John B. Duthie, R. R. Duthie, G. F. Duthie and Margaret Duthie, with head office at Toronto.

The Central Foundry has been incorporated under Ontario charter with a share capital of $200,000 for the purpose of carrying on a general foundry business. The provisional directors are H. L. Bowers, H. T. Bush and R. C. Donald, with head office at Toronto.

The Dominion Office & Store Fittings Co. has been incorporated under Ontario charter with a capital stock of $40,000 for the purpose of manufacturing office and store fittings, etc. The provisional directors are D. H. Gillies, C. R. Somerville, J. McK. McDermid, T. H. Weldon and C. W. A. Woodburne, with head office at London.

The Amalgamated Petroleum Producers Limited, have been incorporated under Ontario charter to produce and deal in petroleum and gas, with a capital stock of $40,000. The provisional directors of the company are, C. Brown, H. Quinlan, and W. M. Pontom, with head office at London, Ont.

Cobalt & Hudson Bay Developing Co. have been incorporated under provincial charter with a share capital of $100,000, to carry on the business of prospecting and developing. Provisional directors are, J. E. Day, J. M. Ferguson, E. V. O'Sullivan, A. H. Day, and J. J. O'Sullivan; head office, Haileybury.

The Bothwell Locomotive Company has been incorporated under Ontario charter with a share capital of $100,000 for the purpose of manufacturing and dealing in locomotives, etc. The provisional directors are James McLauchlan, F. W. Harrison, J. G. Hay, S. J. Parker, G. A. Bothwell and A. G. MacKay, with head offices at Owen Sound.

The National Brass Manufacturing Co. has been incorporated under Ontario charter with a share capital of $100,000 for the purpose of manufacturing and dealing in brass and other metal goods. The provisional directors are: C. D. Fergusson, Joseph Grey, and E. J. Saunders, with head office at Toronto.

Toronto & Belleville Rolling Mills have been incorporated under Dominion charter with a capital stock of $599,999, for the purpose of operating mills for the manufacture of iron and steel. The provisional directors are W. D. Morris, Henry Nicholson, G. E. Barber, R. G. Code and E. F. Burritt with head office at Belleville.

Jenkins Bros. have been incorporated under Dominion charter with a capital stock of $200,000 for the purpose of manufacturing and dealing in valves, lubricators, injectors, etc. The provisional directors are: A. B. Jenkins, F. T. Swain, E. Brady, H. D. Gordon, and W. R. Stewart, with chief place of business at Montreal.

Carbolite Carbolineum Co., Limited, have been incorporated under Ontario charter with a share capital of $40,000, for the purpose of carrying on a paving and contracting business and treating wood. The provisional directors of the company are, C. W. Laker, G. H. Kilmer, W. H. Irving, G. D. Kelley, chief place of business, Toronto.

The Hadley Cement Co. of Canada, have been incorporated under Dominion charter with a capital stock of $50,000 for the purpose of manufacturing and dealing in leather and rubber cement. The provisional directors are W. O. Hadley, D. J. Herlihy, J. P. Dent, W. J. George and Thos. Hall, with head office at Cote St. Paul, Que.

The Automobile Company of Hamilton has been incorporated under Ontario charter with a share capital of $40,000 for the purpose of manufacturing and dealing in motor vehicles and supplies. The provisional directors are: W. R. Moore, H. H. Hodgson, W. M. Clendenning, S. D. Biggar, and John Jackson, with head office at Hamilton.

The Nova Scotia Land Co., Limited, incorporated under Dominion charter with a total capital stock of $200,000 to carry on a real estate and constructing business. The directors of the company are, R. V. Sinclair, A. F. May, A. MacFarlane, W. H. Middleton, and C. T. Moffatt; chief place of business to be Halifax, N.S.

The Windsor Dredging Co., Limited, have been incorporated under provincial charter with a capital stock of $40,000, for the purpose of constructing and maintaining machinery and dredging apparatus and carrying on dredging and dock work. Head office, city of Windsor. The directors being, A. G. Drake, A. Peltier, W. J. McKee, H. W. Allan and G. E. Brooks.

The Contractors' Supply Co. have been incorporated under Ontario charter with a share capital of $100,000 for the purpose of manufacturing and dealing in builders' supplies and structural material. The provisional directors are T. W. Self, Frank Saunders, Richard Chalkley, W. Smallwood, J. Crang, F. R. Love and T. E. Cannon, with head office at Toronto.

The Ionontok Estate Co. incorporated under Dominion charter; total capital stock, $30,000; to purchase and maintain land and to manufacture steam, gas and electricity. Directors of the company are V. E. Mitchell, A. R. Holden, C. H. McLeod, A. A. Robertson, H. M. Jaquays, A. F. Byers, and C. W. Gamble, with chief place of business at Montreal.

The Montreal Reduction and Smelting Co. of Canada has been incorporated under Dominion charter with a capital stock of $2,000,000 for the purpose of carrying on a mining and smelting business. The provisional directors are: J. B. E. Leonard, B. Burland, L. J. Cartier, A. Robert, A. Tremblay, P. Theriault, J. E. Theriault, O. Lemire, P. Tetrault, O. Theriault, J. M. Mitchell, J. H. Brown, O. Frechette, and E. L. Patenaude, with chief place of business at Montreal.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

An iron foundry will be built at Red Deer, Alta.

Little Bros.' sawmill was destroyed at Haileybury, Ont.

Calgary permits this year have reached a half million.

N. A. Beach will build a saw mill at Georgeville, Que.

Pembroke, Ont., asks for tenders for a new town hall.

The Hoidge Marble Co. will build a factory in Toronto.

The town of Indian Head is installing a waterworks system.

Carberry, Man., asks for tenders for an electric light plant.

John E. Smith, of Brandon, will erect a block to cost $50,000.

Regina has voted $37,550 for public improvements this year.

The Norton Mfg. Co., Hamilton, will build a $5,000 addition.

Sburly & Dietrich, Galt, Ont., are erecting a new warehouse.

Brantford has issued permits to the amount of $100,765 this year.

Winnipeg has selected a site for a new bridge across the Red River.

Richmond, Que., will spend $25,000 on their waterworks system.

The Victor Beaudry Estate, Montreal, will erect a $30,000 building.

The Alberta Milling Co. will double their capacity at Edmonton.

St. Catharines building permits so far this year amount to $200,000.

The township of Brighton, Ont., will erect three new steel bridges.

The Western Elevator Co. will build a large elevator at Fort William.

R. McQuarrie will build a lumber and shingle mill at Port Kells, B.C.

The Saskatchewan Hotel Co. will erect a $150,000 hotel at Regina, Sask.

G. H. Walton will build an apartment block in Winnipeg to cost $80,000.

The Dow Cereal Co. contemplate building an oatmeal mill at Minnedosa.

J. R. Booth will build an addition to his paper mill at Chaudiere Falls.

The Imperial Oil Co. will erect an oil warehouse at Portage La Prairie.

The Barber Asphalt Co. will establish a permanent works in Vancouver.

The Regina city council will spend $400,000 on street improvements.

The Shipman Electrical Supply Co. has opened showrooms in Winnipeg.

The Calgary Milling Co. have let contracts for a 1,000-barrel flour mill.

Fort William has issued building permits representing $90,000 this year.

The Dominion Iron & Steel Co. shipped during April 15,500 tons of steel.

Winnipeg building permits for 1906 have passed the three million mark.

J. Y. Griffin, of Winnipeg, will build a cold storage plant at Fort William.

L. Higgins & Co., Moncton, N.B., will build a shoe factory at Yarmouth, N.S.

The Berlin Interior Hardwood Co. are building a large addition to their plant.

The Vancouver Warehouses will erect a $70,000 bonded warehouse in that city.

The Canadian Canners will establish a third plant at Hamilton to cost $20,000.

The Nova Scotia Steel Co.'s machine shops at Bell Island were destroyed by fire.

Richmond, Que., has passed a by-law to raise $25,000 for a waterworks system.

Herbert Radford has let the contract for a five-storey warehouse in Winnipeg.

A firm named Compeau & Leduc will put in a saw mill plant at Hazelton, B.C.

The farmers near Tenby, Man., are organizing a company to build a flour mill.

J. Burnside, Hamilton, will open a sash and door factory at Lethbridge, Alta.

John E. Askwith and others have purchased a site for a mica factory in Ottawa.

Carman, Man., ratepayers will vote on a by-law to install an electric light plant.

The Natural History Society, of Montreal, will erect a museum this year.

AN APPRECIATION FROM THE SOUTH

Professor C. M. McKergow, professor of mechanical engineering, University of Virginia, writes, "Let me express my appreciation of your interesting and practical paper. I can say without hesitation that no paper coming into our library is more sought after by our engineering students."

Darling & Pearson ask for tenders for a laboratory for the University of Toronto.

Fred Fry has the contract for installing a waterworks system at Indian Head.

The Kemp Manufacturing Co. ask for tenders for a six-storey factory in Winnipeg.

Cline's furniture factory at Stratford was damaged by fire to the extent of $3,000.

The contract has been let for the building of Crowe's Iron Works plant at Guelph.

B. B. McCarthy, reeve of Thamesford, Ont., asks for tenders for five cement bridges.

Cassette & Trudel's sawmill at St. Tite, Que., was destroyed by fire. Loss $10,000.

Within eight months Fort Frances will have 30,000 horse-power ready for distribution.

Since the fire at Fort Frances, Ont., the amount of buildings started is $230,000.

Port Arthur has already a half million worth of buildings contracted for this year.

The plans for the Canada Iron Foundry's plant at Fort William are being prepared.

Milledge Van Buskirk, Harcourt, N. B., will start a brick manufactory near that place.

The city of Brandon asks for tenders for large quantities of iron pipe, hydrants, etc.

The Warren Church Organ Co. has been organized at Woodstock to build an organ factory.

The production of all kinds of steel ingots in Canada during 1905 amounted to $403,449.

P. Leblanc's carding and planing mills at Napierville, Que., were burned down. Loss, $4,000.

The Dominion Reduction Company's plant at Kenora was destroyed by fire. Loss $20,000.

The Locks Water Power, Peterborough, will be offered for sale by auction on June 13.

Fort Frances, Ont., will ask the electors to vote $57,000 for waterworks and electric lights.

The Felt Roofing Co., Brantford, expect to have their factory running in a week or two.

The Queen City Plate Glass & Mirror Co., Toronto, suffered considerable loss through fire.

The Canadian Mining & Smelting Co. contemplate establishing a concentrator in Vancouver.

The Montreal Rolling Mills Co. have taken out a permit for a building to cost $60,000.

Some large quantities of mica are being taken from Edward Smith's mine at Burgess, Ont.

Owen Sound ratepayers passed by-laws to issue debentures to the amount of

$45,000 to extend the gas and electric light plants.

Goold, Shapley & Muir are contemplating extensive additions to their plant at Brantford.

H. Bedell has started a factory at Picton, Ont., for the manufacture of cement bricks.

While boring a sewer test at Fort Frances, Ont., a small flow of natural gas was struck.

Kingston will ask the ratepayers to vote $85,000 for extensions to the water and light plant.

Taylor Bros.' sawmill, and the electric light plant at Haileybury were destroyed by fire.

The works of the Sand Lime Brick Company in Brantford will be in operation by July 1.

The King Milling Co. will build and operate a planing and lumber mill at Cranbrook, B.C.

Archibald & Getchen, of Winnipeg,, will erect a flour mill at Kenora for local capitalists.

The machine shop of James Acline, Limited, Stratford, Ont., has been totally destroyed by fire.

A new electric contracting business has been started in Fort William by Fielder & Johnston.

Carman, Man., will submit a by-law to raise $58,000 to instal light, water and fire systems.

The Western Iron Works, Winnipeg, will go into the manufacture of ornamental iron work.

The output of copper ore from the Boundary Mines, B.C., has reached 430,-243 tons this year.

The new sawmill at Port Moody, B.C., is now in operation, as is also the shingle mill in connection.

The Sarnia Match Co. will at once commence building a factory that will employ 300 hands.

Victoria, B.C., is having $9,000 worth of electrical machinery installed in its new power house.

The Great West Power & Machinery Co. have been organized to build a gas works at Winnipeg.

J. R. Gillis, Arnprior, Ont., has placed an order with the Robb Engineering Co. for a 150 H.P. engine.

The Seaman-Kent Co., of Meaford, lost their dry kilns by fire, together with 100,000 feet of lumber.

The Toronto & Hamilton Sewer Pipe Co. had their Hamilton works destroyed by fire. Loss $25,000.

A discovery of an 85-foot vein of copper is reported on the Judge-Jumble mine in Cobalt district.

W. J. Ireland, architect, of Stratford, is making plans for a three-storey apartment house in that city.

It is reported that American capitalists will erect a large flax mill at a point in Saskatchewan.

The Maple Leaf Milling Company will erect a large mill and elevator at Kenora, Ont. Work will be commenced May 1.

Shurly & Dietrich, of Galt, will enlarge their plant by the addition of a warehouse 130 by 50 feet.

The St. Catharines Building & Paving Co. have reorganized and commenced the manufacture of hollow blocks.

The Hamilton Steel & Iron Co. will open their new spike mill at their smelting works in a few days.

The Toronto and Hamilton Sewer Pipe Co. will rebuild at Hamilton; their works destroyed by fire.

Picton is to have a $30,000 collegiate institute, a $10,000 Carnegie library and a $25,000 house of refuge.

The Electrical Construction Company, London, has given an option on its plant to an American syndicate.

It is understood that the International Electric Co., of London, will absorb the Electrical Construction Co.

The British Columbia Electric Railway Co. will extend their lighting system from Steveston to Ladnor.

The Canadian Rubber Co., Montreal, will increase its capital to two millions, and will extend their plant.

The Wade Manufacturing Co. has been organized in Dundas, Ont., to manufacture silver-plated novelties.

J. McDairmid & Co. have the contract for an 18 stall engine house at Broadview, Sask., to cost $60,000.

A canning factory will be erected at Tilbury, Ont. H. E. Edgecombe, of Strathroy, will be manager.

W. H. Clark, Edmonton, is at the head of a company who are building a planing and saw mill near that city.

The Jackson Wagon Works is moving from St. George to Galt, where a $12,-000 loan has been voted them.

Madison Williams, manufacturer of mill machinery, Port Perry, contemplate establishing a plant in Lindsay.

R. L. Frost has commenced operations in connection with installing the Brooke lighting system in Owen Sound.

The New Westminster Board of Trade will advertise their industrial advantages through the daily papers.

The British Columbia Copper Co. have started to expend $300,000 on their smelter, machinery and equipment.

The Vancouver Island Portland Cement Works will increase their plant to produce 300 barrels a day more.

The Hamilton Steel and Iron Co. will build another 400 ton blast furnace either in Hamilton or on Lake Erie.

The Dominion Copper Co. have purchased a 30 drill compressor, to be used in their mines at Phoenix Camp, B.C.

The basket-making plant of Geo. H. Williams, Thorold, Ont., is offered for sale by G. B. Burson, St. Catharines.

The Bowser Manufacturing Co. will build a factory at Riverdale, Toronto, for the manufacture of gasoline tanks.

W. W. Scott's furniture factory at St. Louis de Mile End, Montreal, was destroyed by fire. The loss is about $20,-000.

Winnipeg capitalists are applying for a charter to incorporate the Colonial Bank of Canada with a capital of $3,000,000.

John Crowe and others, of Guelph, will convert the Crowe Iron Works, recently damaged by fire, into dwellings.

The business men of Fort Frances, Ont., have organized a business association with a view to developing the town.

The Jenckes Machine Co., Sherbrooke, Que., have built a 250-horse-power hoist for the Granby smelter at Phoenix, B.C.

The village of Rigaud, near Montreal, advertises bonuses and special inducements to manufacturers to locate there.

The Belleville Rolling Mills have been purchased by J. W. Wardrope, of Ottawa, who will install more machinery.

The Canadian Westinghouse Co., Hamilton, will spend $200,000 increasing their plant and will employ 500 more men.

C. N. Choate, of Woodstock, has invented a new cement block machine and with others will manufacture it in that city.

Business men of Nelson, B.C., have formed a 20,000 club and are taking aggressive steps to increase their population.

The work on the extension of the Canadian General Electric Co's works in Peterborough will be commenced at once.

The Canadian Manufacturers' Association are urging Montreal City Council to advertise its manufacturing advantages.

James J. Hill has ordered 20,000 tons of steel rails from the Soo Company and 3,200 from the Dominion Steel Company.

The town of Fort William is negotiating with a car wheel foundry company with a view to its establishment there.

The Minister of Mines for Ontario announces that a free site will be given any one building a smelter in New Ontario.

The Hensall, Ont., foundry has been sold to Hunt & Boyd, London, who will manufacture radiators and plumbing supplies.

The Dominion Iron & Steel Co. have concluded a contract with the Pacific Construction Co. for 4,000 tons of steel rails.

P. Burns & Co., Vancouver, will erect an abattoir in that city this year, which will employ a large number of hands.

C. R. S. Dinnick has the contract for the new press building at the Industrial Exhibition, Toronto. The price was $9,999.

North Battleford has become incorporated as a town and the citizens are taking up the matter of waterworks and sewage.

The Canadian Westinghouse Co. have made a contract to equip the Windsor, Essex & Lake Shore Railway with

motors, transformers, etc. The amount is over $100,000.

The Meisell Manufacturing Co., of Port Huron, will establish a plant in Winnipeg for the manufacture of milling machinery.

The Mount McKay brick and tile works of Fort William have been purchased by Geo. Alsip, a Winnipeg contractor.

Negotiations are understood to be on foot for the consolidation of the Granby Rubber Co. with the Canadian Rubber Co.

M. A. McNamara, who owns 240 acres bordering on the canal at Peterborough, offers free sites there to reputable manufacturers.

H. J. E. Wilcox has found a large body of silica sand on his farm near Niagara Falls. This sand is used in foundries.

The Dodge Mfg. Co., of Toronto, are equipping with shafting, etc., the new canning factory of W. R. Wright in Picton, Ont.

The largest and most powerful dredge in Canada, being made by Polsons, Toronto, will commence work at Toronto this week.

Geo. Stevens, of Peterboro, has started a lye factory at that place. About ten hands will be employed at the commencement.

The Bennet Furnishing Co., of London, have temporarily closed down, pending a dissolution of partnership and reorganization.

The Nester estate at Ashland, Wis., will dismantle its saw mills and move the machinery to Thessalon, on the Georgian Bay.

The Bridge and Structural Iron Workers' Union have signed an agreement to work for 30 cents an hour with the usual overtime rates.

A manufacturing company is negotiating with Port Hope with a view to establishing a business at the radiator buildings there.

The partially completed factory of the Henderson Roller Bearing Co., Toronto, is offered for sale by the Trusts & Guarantee Company.

A new match factory is to be erected and equipped in Sarnia, Ont., and Mr. J. M. Diver is looking after the interests concerned.

James T. Thompson, of Helena, claims to have discovered platinum on the Pacific coast in British Columbia, in good quantities.

McLeod, Alta., has offered the Gate City Milling Co., of Keokuk, Ia., a free site and tax exemption to build a 200-barrel flour mill.

The Shearer, Brown & Mills Co., of Montreal, have purchased the Dixon timber limit at Buckingham, Que., and will build mills there.

The Prairie City Oil Co., St. Boniface, had their plant destroyed by fire. The loss is about $20,000. They will carry on business.

A. McKay, of Seattle, is at the head of a company, who, it is reported, will build a glass manufacturing plant at New Westminster.

The Crandall Cutlery Co., of Bradford, Pa., ask for a free site and tax exemption in London, Ont. The council has the matter in hand.

The Bowmanville Foundry Co. will build a three story addition, 60 by 32 feet. Their specialty is light castings for piano work, etc.

The MacGregor-Gourlay Co. will make large additions to their works at Galt which will necessitate employment for 150 additional hands.

Chappel Bros. & Co., Sydney, N.S., are installing a four-and-a-half-ton molding machine, made by J. Ballantine & Co., of Preston, Ont.

A. W. Cox, of Skagit county, Washington, has purchased a saw mill at Gibson's Landing, B.C. He will manufacture interior finishing.

The Brantford Screw Works have secured a site in that city upon which they will build a new plant, provided a railway switch is put in.

Iron pyrites is being mined in Hastings county and shipped to Buffalo, where it is manufactured into sulphuric acid of a high quality.

The Montreal Light, Heat & Power Co., of Montreal, will erect a power house at Soulanges, Que., which will cost a million dollars.

The marriage of Dr. J. J. Hardy, secretary-treasurer of Kingston Locomotive Works, to Miss Anna Fitzhugh Powell was celebrated recently.

The Dominion Copper Co. will put in a third blast furnace at Boundary Falls, B.C., which will bring the daily output up to 1,200 tons of ore.

The Amherst Foundry Co. have commenced the work of building an addition to their molding shop. The extension will be forty by sixty feet.

The Henderson Roller Bearing Co. will be reorganized under the name of the Dominion Henderson Bearings, and will carry on the business.

Russell and Dougherty, two American capitalists, have been in Brantford planning to establish a factory there to manufacture metallic packing.

The Yale-Columbia Lumber Co. have acquired the Kettle River Lumber Co.'s business and will operate four saw mills in British Columbia this year.

Mr. F. Wilson, of the firm of Williams & Wilson, machinery merchants, Montreal, sailed by the Virginian on a six weeks' business trip to England.

The Weed Chain Tire Grip Co., of New York, who manufacture a chain tire grip for automobiles, have established a branch factory at Bridgeburg, Ont.

There is some talk of developing a water power on the Saskatchewan River near North Battleford, which is capable of yielding 2,000 H.P the year round.

The molders of Hamilton have settled their troubles with the employers. Their scale of wages will remain the same. The employers wanted to make a cut, while the men wanted an increase.

The Copper Mining and Smelting Co. of Ontario now own the old Bruce Mines, which are said to be still rich in copper. A new smelter will be built.

The Canadian General Electric Co. ask the city of Peterborough for a fixed assessment of $150,000 on condition they expend $300,000 more on their plant.

The steamer Bergenus is at the Dominion Iron & Steel Co's piers, Sydney, unloading the first iron ore cargo of the season from Wabana, Newfoundland.

Chas. O. Spelman, of Hamburg, N.Y., contemplates starting a plant within the next few months and will be in the market for a large quantity of machinery.

The Lake of the Woods Milling Co. will build an oatmeal mill at Portage La Prairie, and also extend their elevator system to about 30 more places in the west.

Active work has now begun in preparing the site of the new Royal Bank building on St. James street, Montreal. It will be pushed to completion as rapidly as possible.

The Western Electric Company, of Berlin, have added two large stamping presses to their plant, and other equipment for the speedy turning out of trunk trimmings, etc.

Fort William will vote on a by-law to grant tax exemption to the Canada Iron & Foundry Co., of Montreal, who will build a branch there costing $125,000, and employing 300 men.

The additions to be made to the Cockshutt Plow Works at Brantford, will consist of a 70 foot extension to the storage building, and a like sized addition to the molding shop.

The Amherst Foundry Company will increase its capitalization to $450,000, and will make extensive additions to their plant at Amherst, N.S. A branch has been opened in Winnipeg.

A. E. Knapp, representing Seattle capitalists, has taken an option on copper lands on the Queen Charlotte Islands, B.C. Reports say that these properties are rich in copper ore.

The Hamilton Steel & Iron Co., Limited, have decided to erect a second blast furnace with a capacity of 400 tons per day. The new blast furnace will either be on Lake Erie or at Hamilton.

Wm. Lorimer, of the Lorimer Automatic Telephone System, Chicago, has announced that his company will build a large plant in Peterborough for the manufacture of telephone appliances.

The American Tobacco Co. have completed arrangements for the erection of a large new plant on St. Antoine street, Montreal. It will be built by the Dominion Engineering & Construction Co.

The village of Rigaud, Que., is offering special inducements to attract manufacturers to that place at the present time. These inducements include free site and water power and bonuses.

It is expected that the Atikokan iron mines will be ready to ship ore by the 1st of August, by which time the contract with the Canadian Northern comes into force, to ship 600 tons of ore daily.

The American Locomotive & Machine Works will expend $1,000,000 in extending their works at Longue Pointe. The principal enlargements will be the steel bridge and the locomotive departments.

The new mill being erected by the Eagle spinning mills in Hamilton is the first cotton mill in Canada to be built entirely of reinforced concrete. The Kahn system of reinforcement is being used.

The following officers have been elected for the Northern Iron & Steel Co., Limited, of Collingwood: President, Major J. A. Currie; vice-president, J. C. Lindop, St. Thomas; secretary, Duncan Donald.

The Schwab interests, of Pittsburg, have purchased $500,000 worth of iron ore from the Mineral Range Iron Mining Co. The ore will be taken by rail to Port Hope and ferried across the lake from there.

A New York firm has made a contract with Mr. Farnham, of the Hastings county iron mines, for a large supply of ore. A railway will be at once built to the mines from L'Amable station, five miles distant.

A sand-lime brick manufacturing establishment is to be built in Brantford. The property and building will cost $10,000, and $30,000 worth of machinery is to be installed. Mr. W. D. Schultz is managing director.

M. A. McNamara, Peterborough, is offering free sites to manufacturers who will locate there. These sites are to be taken from a farm of 240 acres bordering on the canal, and having G.T.R. and C.P.R. tracks nearby.

The Robb Engineering Company have received an order through the Canadian Westinghouse Co., of Vancouver, for two 20 horse-power engines to be used for lighting purposes on the C.P.R. steamer Prince Royal.

The Dominion Copper Co., of Phoenix, B.C., will install a 30-drill compressor and a hoist of 150 horse-power. With these and other new machines they purpose installing they will be able to treat 1,200 tons daily.

The Dominion Engineering & Construction Co., recently incorporated, have received the contract for constructing the new $150,000 plant for the American Tobacco Company, on St. Antoine street, Montreal.

The Keewatin Power Co., Limited, are advertising the sale of their developed water power at the outlet of the Lake of the Woods on the Winnipeg River. The horse power developed is 28,000 by a fall of nineteen feet.

The Nester Estate of Detroit and Baraga, are dismantling their large sawmill in Ashland, Wis., and are moving their machinery to the Georgian Bay district, Ontario, where they recently purchased a large tract of timber land.

McLean & Sophus, Montreal, are putting on the market a new sketch book, which is a combination of two old ideas, i.e., sectional paper for sketching and carbon copying. It is meeting with approval wherever shown.

Mr. F. Johnston, manager of the J. C. McLaren Belting Co., Montreal, is absent from the city on a several weeks' trip visiting the firm's different agencies between Montreal and Winnipeg. He will establish a branch in the latter place.

Work has been commenced on the Model City on Lake Michigan where the Indiana Steel Co. proposes to build the largest steel mills in the world at a cost of $10,500,000. The new city is to be built to accommodate the toilers at the mills.

Keating & Duncan have opened offices at the Home Life Building, Victoria street, Toronto, where they will carry on business as civil engineers, special attention being given to hydraulic, municipal, electrical and industrial undertakings.

The Upper Canada College, Toronto, has placed an order with the Robb Engineering Co., Limited, for a 150 horse power Robb-Mumford boiler, and one of 130 horse-power has been ordered by the Hudson's Bay Co. for their store at Winnipeg.

There is a probability of blast furnaces being established on the Ashbridge's Marsh land in Toronto shortly. The assessment commissioner is negotiating with the interested parties, and prospects are bright for an agreement being reached.

The Transcontinental Railway Commission are inviting tenders for 65,000 gross tons of eighty-pound steel rails (open hearth or Bessemer) and the necessary fastenings, and 1,545,000 railway ties. Tenders will be received up to noon of June 7.

As reported in Canadian Machinery some time ago, the Brantford Screw Co., Brantford, Ont., have decided to enlarge their plant considerably. Already much machinery has been ordered. The capital stock of the company has been increased to $300,000.

The Cockshutt Plow Co., Brantford, are going to extend their plant. The molding shop is to have a 70-foot addition, as is also the iron storage building The changes that are being made will allow room for the extension of the experimental department.

Allis-Chalmers-Bullock are sending to the trade the fifth series of monthly calendars showing coats of arms of the different provinces of Canada. The latest is that of Manitoba. No doubt they will send them to any reader of Canadian Machinery on request.

The Canadian Westinghouse Company Yonge street, Toronto, have recently added to the equipment of their shop owing to the increased demand for their output. At present their energies are being devoted to the production of motors of different sizes for motor vehicles, including large drays and conveyances.

J. A. Burnett, who has been for some years connected with the Montceal Light, Heat & Power Co., has been appointed superintendent and electrical engineer of the Southern Counties Railway, which will connect Montreal with Longueuil and Chambly Canton.

The Rapid Tool Co., of Peterborough, which has been recently incorporated, expect to be in running shape by July 1st. They have made an agreement with the inventor of the Caldwell lightning auger bit to manufacture this bit in Canada, and will turn out 1,000 of them per day.

The Dominion Sewer Pipe Co., Swansea, Toronto, Ont., are enlarging their plant considerably. Two more storeys are being added to the present building besides which a new coal and clay house has been built. These additions will give the company 60,000 square feet of drying floor space.

The Dominion Brewery Co. have placed an order for a side suction centrifugal pump with the Smart-Turner Machine Co. Another plant at present installing these pumps is the corporation of Meaford, who are being supplied with a complete auxiliary pumping plant, including engine and pump.

Since they have equipped their new foundry with a system of electric cranes and a Roots blower system, John Bertram & Sons, Dundas, find they have on hand a quantity of A1 apparatus that would be very desirable for a smaller plant, and which they are prepared to sell on reasonable terms.

In addition to the plant the Hamilton Steel & Iron Co. have installed for the manufacture of railway spikes, they will also shortly put up a plant for the manufacture of pipes and tubing. Their new blast furnace will have a capacity of 400 tons, but its particular location has not yet been decided upon.

The Dickson Lumber Co., of Peterboro, have conveyed their interests, consisting of mills and timber limits, to a syndicate composed of men from Toronto, Orillia and Boston, for the sum of $600,000. W. D. Loomis, of Toronto, is president of the new company. The Dickson Co. retain their Peterboro and Lakefield mills.

W. H. C. Mussen & Co., dealers in railway and contractors' supplies, Montreal, have purchased the large warehouse situated at Nos. 21 and 23 Colborne street, Montreal. This will give them excellent facilities for handling their goods, as the new warehouse faces the canal, and has railway sidings within 100 feet of the goods entrance.

The output of the Granby Consolidated for the month of April shows approximately 2,000,000 pounds. Late in the Summer additions and improvements will probably have been completed, enabling an increase in the yearly production of copper to 33,000,000 pounds. Within two years or so a further increase to at least 50,000,000 pounds per annum is expected.

The Smart-Turner Machine Co., Hamilton, are at present busy installing

their duplex pumps in the plants of Canadian Canners, Limited, Wellington; E. Leonard & Sons, London; Northwestern Transportation Co., Athabasca Landing; Dixville Butter & Cheese Co., the Berlin Button Works, the Northern Navigation Co., Collingwood; and Loveland & Stone, Cutler, Ont.

Owing to a typographical error in the article "A Talk on Foundry Chemistry." by H. L. Bowers, in the May issue of Canadian Machinery, Si 0_2 – oxide of silicon—read single 02 ; and for Fe S^2 —sulphide of iron—was printed Fess. In the same article there is a sentence which should have read: "Silicon is not in itself a desirable ingredient of cast iron," instead of "Silicon is not a desirable ingredient in cast iron." Not having seen a proof of the article, Mr. Bower is in no way responsible for the non-correction of these errors.

Numerous orders for Beardshaw's high-speed steel are being received from the Canadian trade owing largely to its own merit and the energy of its agent for Canada, Alex. Gibb, 13 St. John street, Montreal. When tested in competition with other high-grade steels, it has met with favorable recognition. The manufacturers of this steel also make high-speed twist drills which have the same durable and stubborn wearing qualities that have made the steel attractive for manufacturing purposes. The manufacturers of it have been established under the name of the Baltic Steel Works, of Sheffield, Eng., for nearly a century.

New Foundry and Machine Shop.

The Western Machine Co., Limited, 493 Dundas street, Toronto, manufacturers of "Monarch" gas and gasoline engines, have just moved to Stouffville, where they will manufacture their gas engines and conduct a general foundry and repair business on the premises formerly occupied by A. Fleury & Son. This firm is expanding considerably and in the new premises will be prepared to supply castings of all lines to manufacturers, any of whom will receive full information by communicating with this firm at their new address.

Lighting Contract.

The Packard Electric Co., of St. Catharines, who are Canadian representatives for the Jandus Electric Co., Cleveland, Ohio, manufacturers of enclosed arc lamps, have been successful in securing the series arc lamp contract from the Saint John Railway Co, St. John, N.B., consisting of 250 figure 80, series A.C. 7.5 ampere lamps, 5-50 light C.C. regulators, 5 standard 50 light switchboard panels with open circuit protectors, and 5-33 K.V.A. transformers. George C. Rough, salesmanager of the company, was in St. John recently and closed the contract. The Packard Company were also successful, through their western manager, G. A. Powell, in securing a similar contract for a 200 light equipment from the city of Winnipeg.

Machinery Wanted.

The by-law for $27,000 to enlarge the electric light plant was carried in Barrie, Ont., on May 16, 1906, by a large majority. The new equipment will consist of water tube boilers, a four hundred and fifty horse-power Corliss valve engine, direct connected to a two-phase, 2,200 volt, revolving field generator, necessary switchboard apparatus, piping, condensers, heaters, pumps, economizers, etc., and a series alternating street lighting system.

Manufacturers' Day.

A new event in the history of the manufacturing interests of Canada and the United States was inaugurated on April 28th when, in response to the joint invitation of the Boards of Trade of Niagara Falls, Ont., and Niagara Falls, N.Y., representative manufacturers from both countries were entertained at the Falls. The committee included E. H. Taylor, chairman, and O. D. Glasgow, presirent; D. B. White, W. A. Arison, and F. E. Dalton, from the Canadian Board of Trade, and Geo. W. Knox, president, J. E. Montague, Geo. F. Nye and John C. Level, from the United States Board of Trade, besides which was a strong reception committee who made the guests feel thoroughly at home when visiting the different power and manufacturing concerns at the Falls. The Canadian representatives left Toronto at 11.30 the evening before on a special train, which was shunted on a siding at Niagara Falls, Ont. The committee of the boards of trade met the visitors, who were taken by special cars to the "Home of Shredded Wheat," where the guests from all quarters had gathered and where breakfast was served in a dainty manner. The itinerary for the day included the inspection of the Hydraulic Power and Manufacturing Co.'s plant on the United States side, the inspection of Niagara Falls Power Co., luncheon at the Ramapo Iron Works, a private car trip around the city, followed by a trip on the Niagara belt line down the Gorge on the American side and up the Canadian side. The different power companies' plants on the Canadian side were then inspected, starting with the fore bay of the Ontario Power Co., and in turn the Electrical Development Co.'s plant, the Canadian Niagara plant, and the power house and transformer building of the Ontario Power Co. A reception was tendered all the guests at the Hospice at 7.00 p.m. The crowning event of a thoroughly eventful day was the banquet at 7.30, where over 300 guests sat down, representing manufacturing interests of over $100,000,000. Addresses were given on practical and technical subjects, including "Technical Education," by Harold W. Buck, and "Possible Uses of Electricity in a Modern Plant," by Calvin W. Rice and Paul Lincoln. Mr. Edward Gurney, of Toronto, was called upon to speak on "Manufacturing in Canada," his address being particularly well received. The visitors from far and near were greatly impressed with the result of their day's visit and the hospitable treatment accorded them at the hands of the Niagara Falls committees. A movement of this kind to bring the manufacturing interests of the two countries into closer unison should be encouraged. It was announced that this was an annual affair, and that every year hereafter it is proposed that the manufacturers meet under similar auspices.

PERSONAL MENTION.

Mr. C. B. Brown has been appointed division engineer of the Atlantic division of the C.P.R., with office at St. John, N.B.

Mr. M. Gregory has recently opened an office at 13 St. John street, Montreal, as sole representative of the Vulcan Smoke Consumer and Fuel Economiser Company.

The Whitman & Barnes Mfg. Co., suffered the loss of one of the members of the company recently in the death of Mr. Geo. E. Dana, chairman of the board of directors. The late Mr. Dana was prominent in business circles where he held many positions of trust and power.

Mr. Sydney Jessop Robinson, master cutler, of Hallamshire, managing director of William Jessop & Sons, is at present in this country on a business trip, in connection with American and Canadian agencies for his firm. Part of his trip was on behalf of the Cutlers Co., a history of which he personally presented to President Roosevelt at the White House as well as a copy to the Congressional library and one to the library at Ottawa. The Cutlers Co. is an unique organization, three hundred years old, somewhat similar to the City of London Guild, this being the first time the history of the organization has been written up. Mr. Robinson is a 282nd master cutler. He arrived by Campania on May 2 and sails June 5. Mr. Robinson reports excellent business in this country and prospects more promising than ever.

* * *

Now Estimating Engineer.

Mr. A. L. Mudge, who has been appointed estimating engineer of Allis-Chalmers-Bullock, Limited, Montreal, is one more Canadian, who, after experience in the great industrial establishments of the United States, has returned to take a responsible position at home. After graduating from McGill University in mechanical engineering in 1894, and in electrical engineering in 1895, he spent one and one-half years with the Canadian General Electric Co., Peterboro, and afterwards some time with the Royal Electric Co., Montreal. From 1899 to 1901 he was electrical engineer for the Grand Trunk Railway System

from Portland to Detroit. From Montreal he went to Pittsfield, Mass., to take charge of construction work for the Stanley Electric Manufacturing Co. During the past two years he has been with the Allis-Chalmers Co. partly in the Bullock Electric Works, Cincinnati, and latterly in the head office, Milwaukee.

CONTENTS

Modern Canadian Manufacturing Plants 209
Plant of Polson Iron Works, Limited, Toronto.

Boring out Bearing in Planer Bed. 213

Laying Corner Stone at Niagara 214

Foundry Practice 215

Editorial 216
The Ontario Power Bill Passed.
Field for Producer Gas.
Problem of the Large Gas Engine.
Few Manufacturers in Parliament.
University Authorities Object.

Milling Cutters 218
Article II. By John Edgar.

Use of Electricity in the Modern Shop 220
By Calvin W. Rice.

Tests on Tempering Tool Steel.... 222
By Prof. H. M. Jaquays.

Producer Gas..... 223
By W. H. Ellis, M.A., M.B.

Progress of Modern Gas Engines.. 224
By C. Chas. Maison, M.E.

Mechanical Reviews..... 227
Caring for Gasoline Engines.
Device for Shaping Machine.
Some Points in the Care of an Engine.

Practical Questions and Answers.. 229

Machinery Development..... 230
Combined Drill Cutter and Reamer Grinders.
Some New Tools.
2 1-4 Inch Turret Machine.
Emery Grinders.

Book Reviews..... 233

About Catalogues..... 234

Power and Transmission..... 235
Pintsch Suction Gas Plants.
Crossley Engine and Producer.
Test of Toronto Waterworks Engine.
Making Marine Engines.
International Gas Engines.
Two London Engines.
Suction Gas Producer.
60 H.P. Campbell Gas Plant.
Letson and Burpee Engines.

Companies Incorporated 242

Industrial Progress..... 243

Personal Mention..... 248

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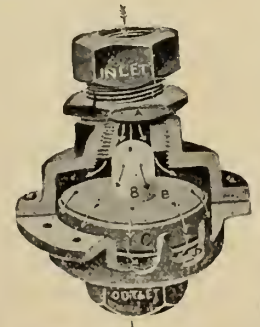

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A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
H. B. Uundrwood & Co., Philadelphia

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John Bertram & Sons Co., Dundas, Ont.
Bickford Tool & Drill Co., Cincinnati.
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Canadion Buffalo Forge Co., Montreal.
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Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
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Krug & Crosby, Hamilton.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson Montreal.

Drills, Bench.

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Canadian Buffalo Forge Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
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Pratt & Whitney Co., Hartford, Conn.

Drills, Blacksmith.

Boynton & Plummer, Worcester, Mass.
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A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Standard Tool Co., Cleveland.

Drills, Centre.

Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
L. S. Starrett Co., Athol, Mass.

Drills, Electric.

B. F. Barnes Co., Rockford, Ill.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drills, Gang.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Pratt & Whitney Co., Hartford, Conn.

Drills, High Speed.

Wm. Abbott, Montreal.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.
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Drills, Hand.

A. B. Jardine & Co., Hespeler, Ont.

Drills, Horizontal.

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Niles-Bement-Pond Co., New York.

Drills, Jewellers.

Pendrith Machinery Co., Toronto.

Drills, Pneumatic.

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Niles-Bement-Pond Co., New York.

Drill, Radial

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Sylvester Mfg. Co., Lindsay, Ont.

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The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

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Hamilton Facing Mill Co., Hamilton.
Sheldon's Limited, Galt, Ont.
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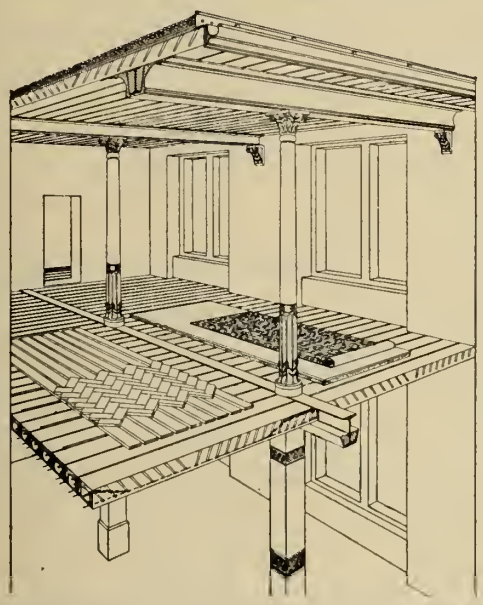

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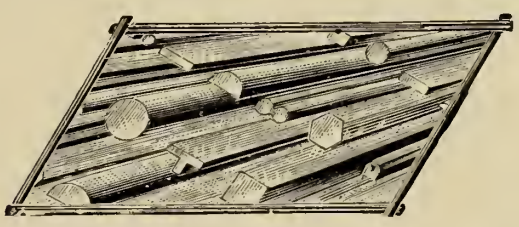

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Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

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Becker-Brainard Milling Machine Co., Hyde Park, Mass.
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Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Milling Machines, Vertical.

Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

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Becker-Brainard Milling Machine Co., Hyde Park, Mass.
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Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
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T. & H. Electric Co., Hamilton.

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Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

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Hamilton Facing Mill Co., Hamilton.

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Chicago Pneumatic Tool Co., Chicago.

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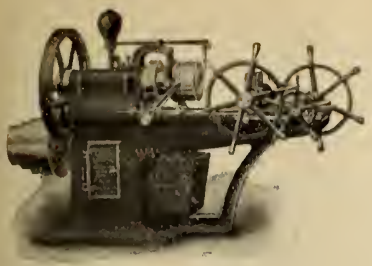

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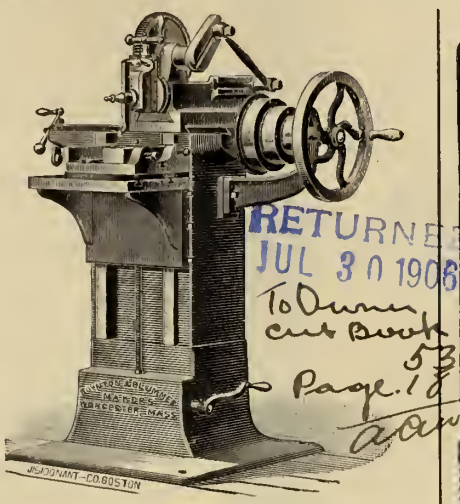

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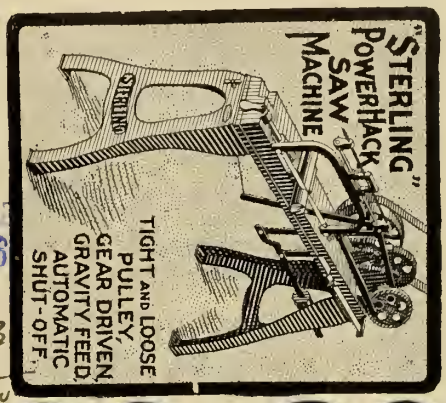

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Allis-Chalmers-Bullock Co., Montreal.
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Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Hespeler Ont.
Ottawa Steel Castings Co., Ottawa.
Standard Tool Co., Cleveland.

ALPHABETICAL INDEX.

A

Abbott, Wm. 73
Allis-Chalmers-Bullock Co. Outside back cover
American Tool Works Co 13
Armstrong Bros. Tool Co. 75

B

Barnes, B. F., Co. 14
Banfield, W. H., & Sons. 9
Becker-Brainard Milling Machine Co. 17
Berlin Electrical Mfg. Co. 67
Bertram, John, & Sons 72
Bickford Drill & Tool Co. 13
Bliss, E. W., Co. 12
Boynton & Plummer 67
Brandeis, Charles. 65
Brown, Boggs & Co 17
Brown & Sharpe Mfg. Co. 74
Budden, Hanbury A. 65
Butterfield & Co. 76

C

Canada Foundry Co. 61
Canada Machinery Agency 71
Canadian Pneumatic Tool Co 79
Canadian Press Clipping Bureau. 65
Canada Chemical Mfg. Co. 3
Canadian Buffalo Forge Co. 11
Canadian Fairbanks Co. 18
Canadian Rand Drill Co. 78
Canadian Westinghouse Co. 1
Canadian White Co 65
Carr, John. 59
Chadwick Bros. 59
Chapman Ball-Bearing Co. 9
Clark-Demill Co. 16
Cleveland Automatic Mach. Co. 71

D

DeCew, J. A. 65
Diamond Saw and Stamping Works. 67
Dillon A., & Son. 59
Dodge Mfg. Co. 5
D'Olier Engineering Co. 11
Dominion Belting Co. 59
Dominion Sewer Pipe Co. inside back cover

E

Economical Mfg. and Supply Co 3
Economic Power, Light and Heat Supply Co 6
Electric Blue Print Co. 65
"Electrical Times". 67
"Engineering" 61
Engineering Specialties Co 59
"Engineering Times" 67
Expanded Metal and Fireproofing Co. 73

F

Fetherstonhaugh & Co. 65
Fetherstonhaugh & Blackmore. 65
Fielding, John S. 65

G

Gibb, Alex. 72
Geometric Tool Co. 75
Goldie & McCulloch Co. 1
Greening, B., Wire Co. 63

H

Hamilton Facing Mills Co 70
Hamilton Pattern Works 59
Howard, Geo. H. 71

J

Jardine, A. B., & Co. 9
Jenckes Machine Co. 3
Jessop, Wm., & Sons 73

K

Ker & Goodwin 73
Kerr Turbine Co. 4

L

Lawrie Engine and Machine Co. 4
Legg Bros. Eng. Co. 70
Leonard, E., & Sons. 7
Lewis, Rice & Son. 80
Link-Belt Eng. Co 6
London Machine Tool Co 12
Lowe, W. H., & Co 71

M

McDougall, R., & Co. 14
McDougall, John, Caledonian Iron Wks 2
McEachern Heating & Ventilating Co. 11
McLachlan Gasoline Engine Co. 7
McLean & Sophus. 78
Marion & Marion 65
Maxwell & Sons. 59
Merrell Mfg. Co. 17
Morang & Co., Limited 61
Morrow, John, Machine Screw Co. 70
Morton, B. K., & Co 73

N

National Machinery Co. 67
New Process Twist Drill Co. 74
Nicholson File Co. 71

O

Otis-Fensom Elevator Co. inside back cover
Ottawa Steel Castings Co. 73

P

Packard Electric Co. inside back cover
Parke, Roderick J. 65
Penberthy Injector Co. 74
Pendrith Mach. Co. 59
Petrie, H. W 15
Potter & Johnston Machine Co. 71
Pratt & Whitney Co. inside front cover
Pringle, T., & Son 65

R

Remington Typewriter Co. 16
Ridout & Maybee. 65
Robb Engineering Co. 2
Royce, James C. 65
Rubbra, Alfred. 59

S

Sadler & Haworth. 68
Sheldons Limited 10
Siegwartbeam Co 63
Smart-Turner Machine Co. 63
Standard Bolt and Screw Co 70
Standard Tool Co 14, 77
Standish, W. T. 17
Starrett, L. S., Co. 76
St. Clair Bros. 59
Stevens Co. of Galt. 76
St. Lawrence Supply Co. 69
Sturtevant, B. F., Co. 10
Spon & Chamberlain. 74
Sylvester Mfg. Co. 7

T

Taylor & McKenzie 9
Technical Pub. Co. 80
Tees & Persse. 59
Toronto and Hamilton Electric Co 79
Toronto Plate Glass Importing Co. 9

U

Underwood, H. B., & Co. 16
Union Drawn Steel Co. 63

V

Volta Electric Repair Works. 78

W

Waterous Engine Works Co. 4
Wayland Williams & Dadson 6
West Haveu Mfg. Co. 74
Wells Pattern & Model Works. 59
Western Machine Co 7
Williams & Wilson 8
Wilmarth & Morman 12
Whitman & Barnes 77

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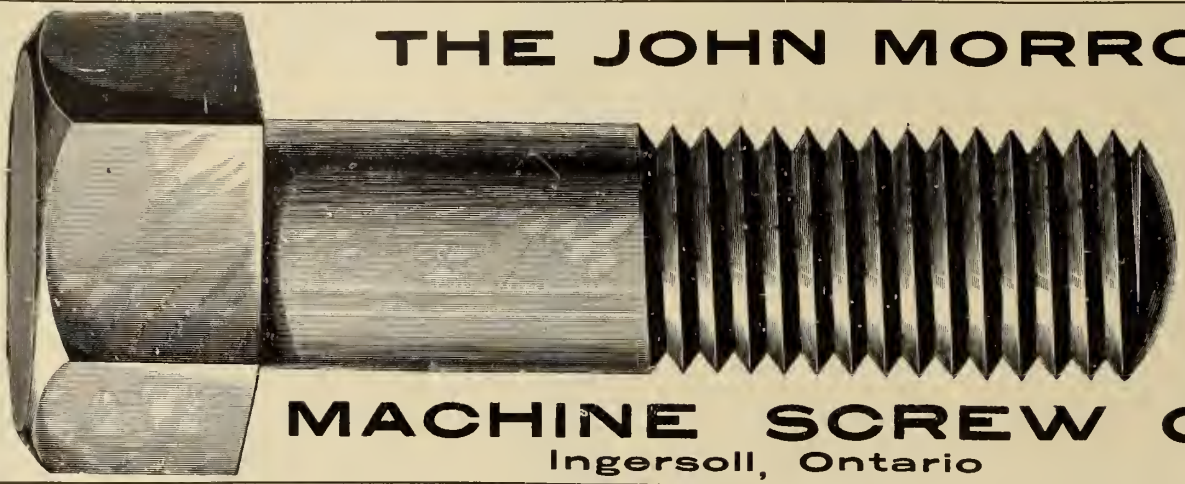

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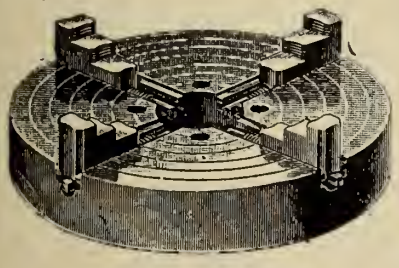

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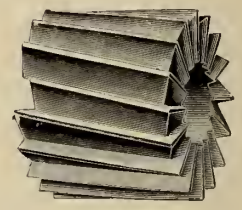

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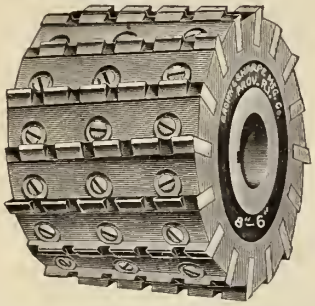

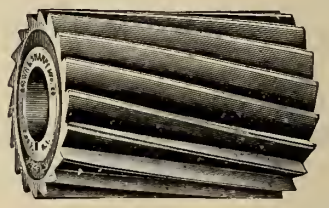

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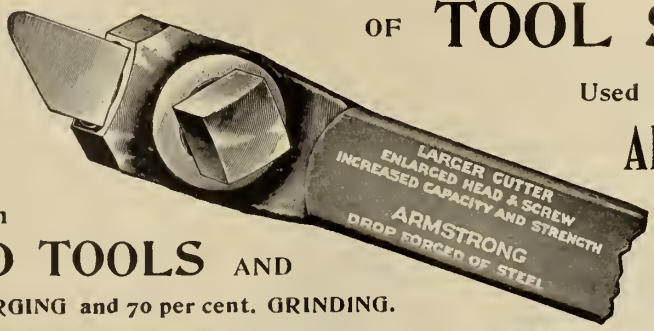

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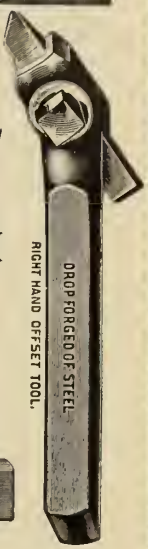

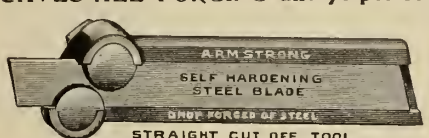

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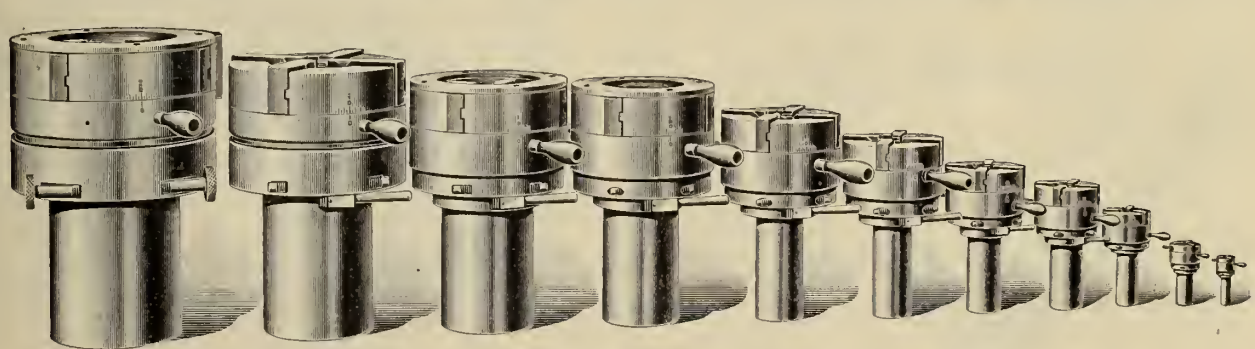

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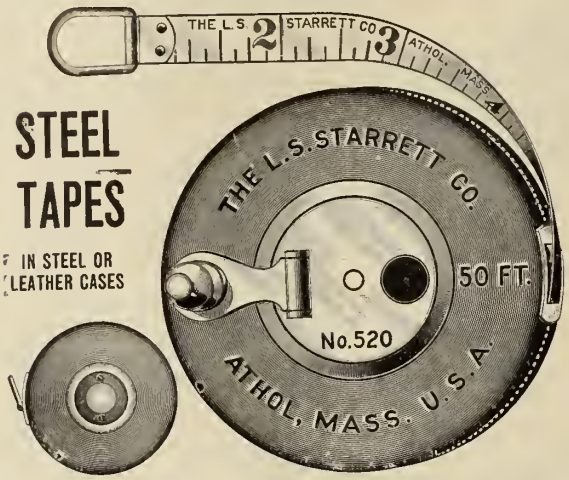

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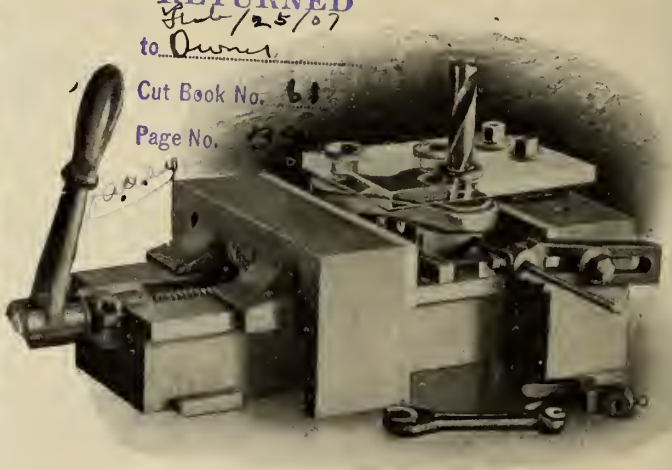

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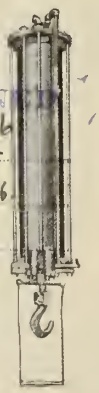

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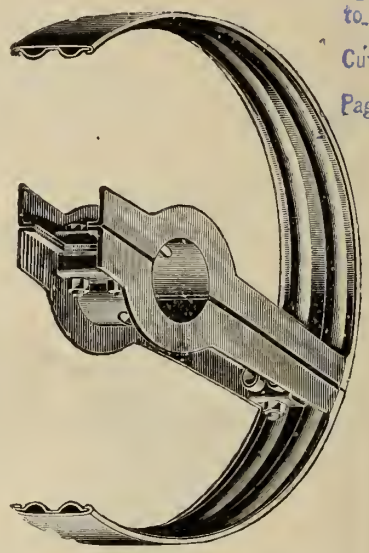

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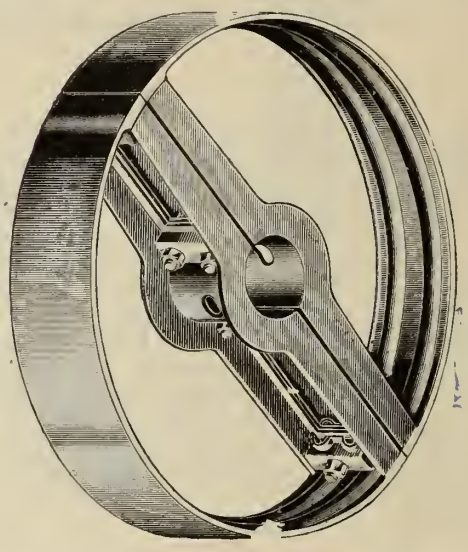

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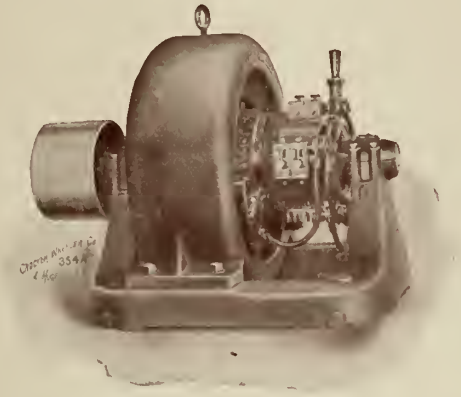

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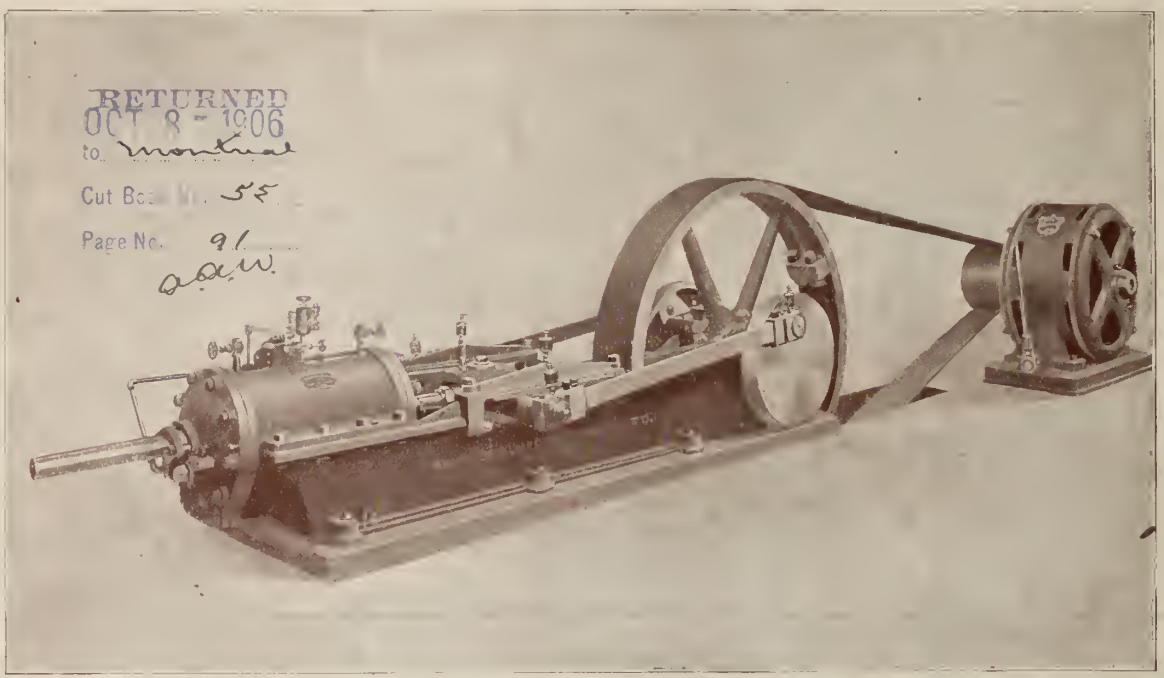

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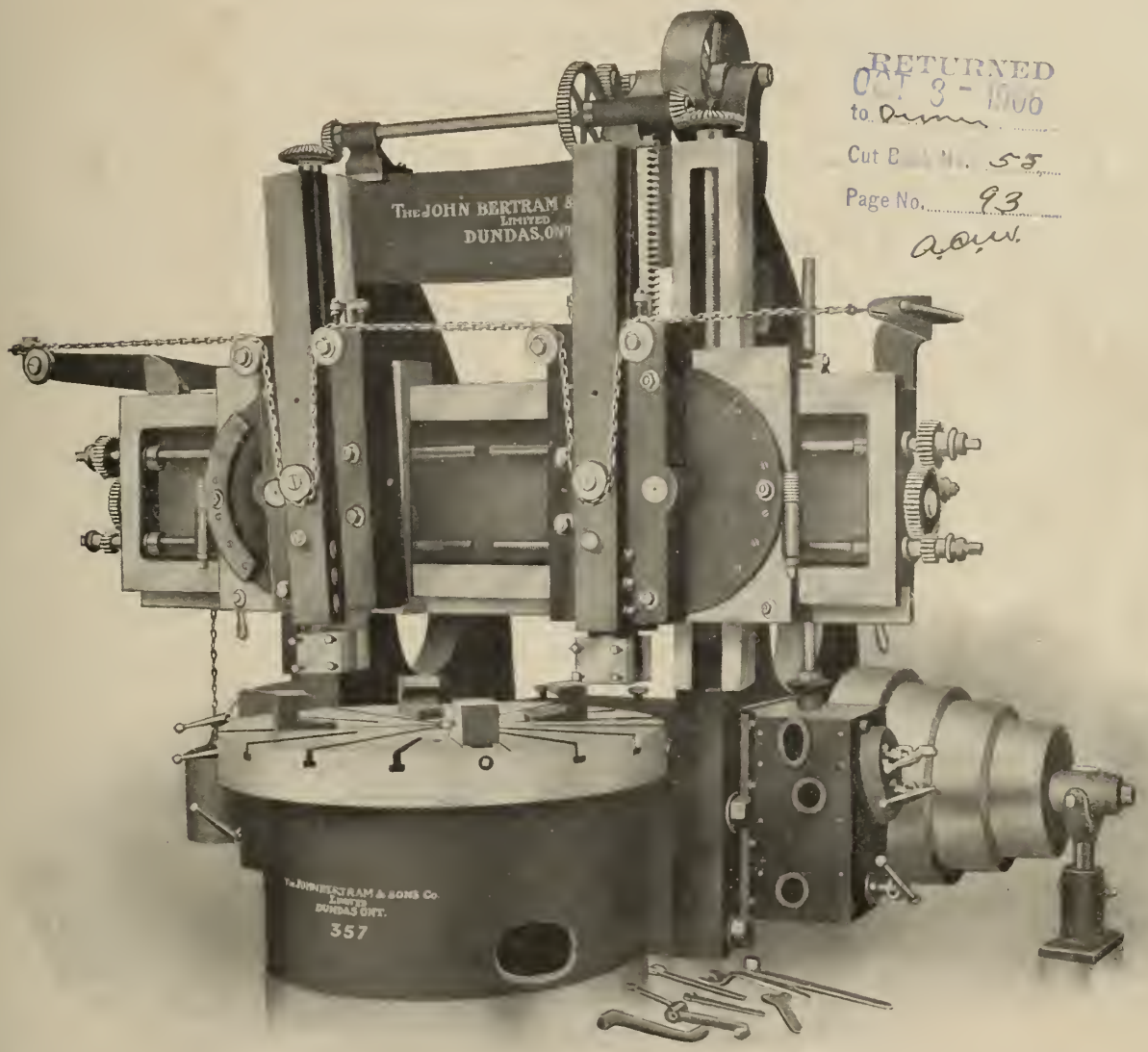

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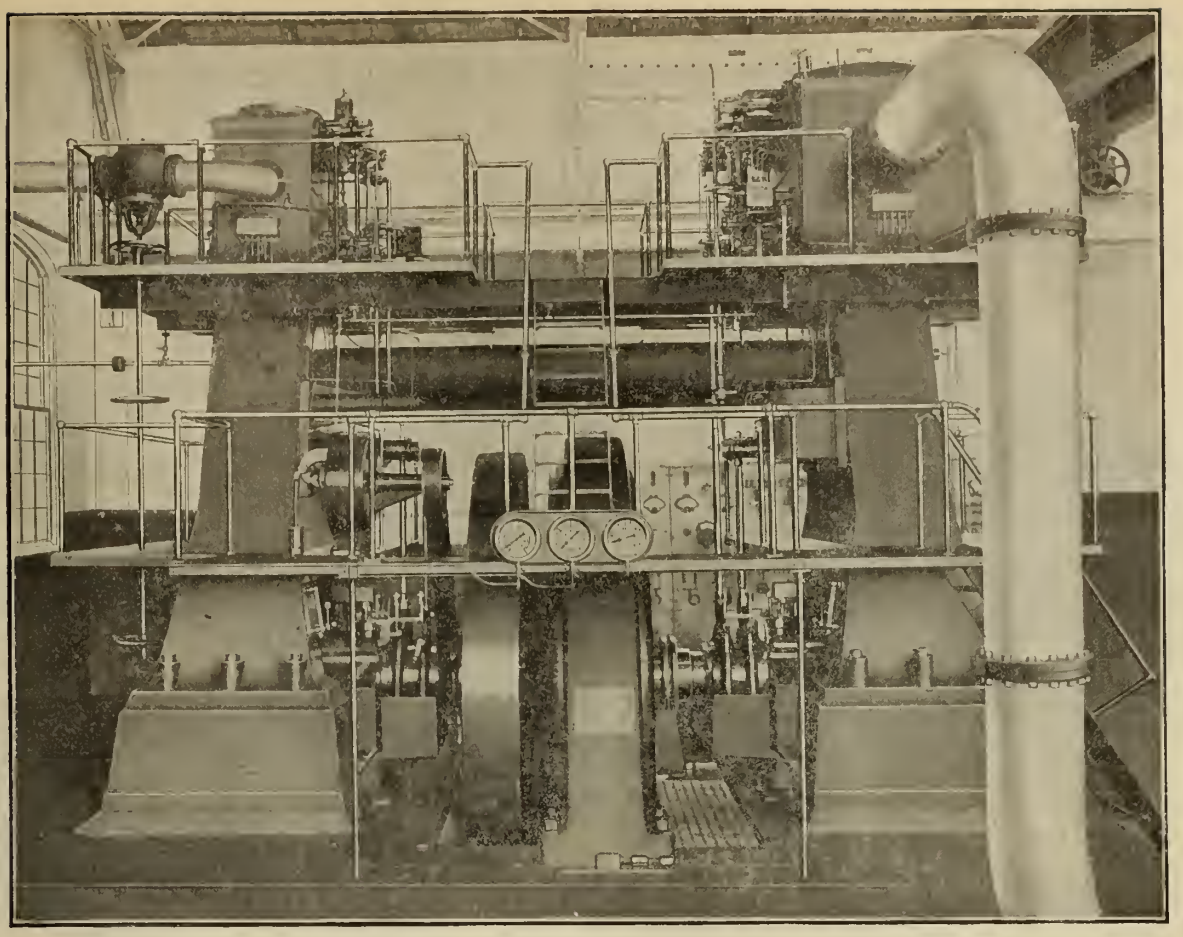

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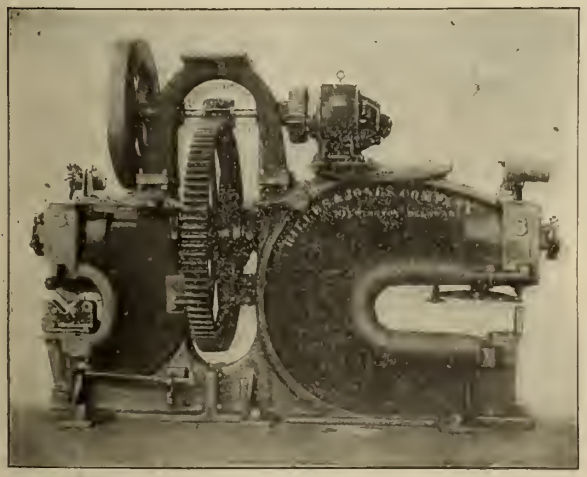

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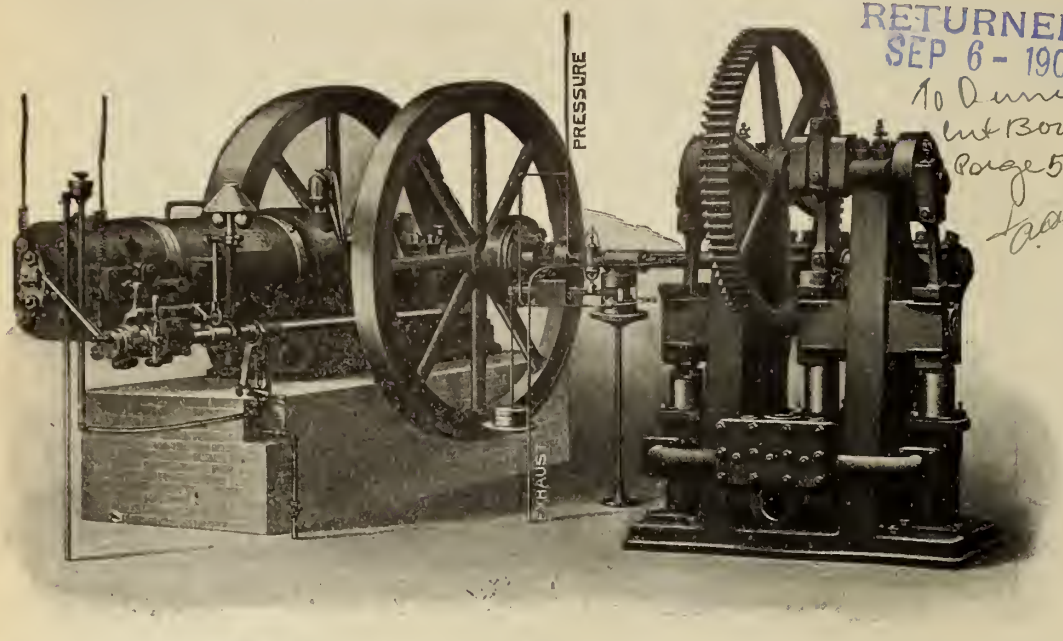

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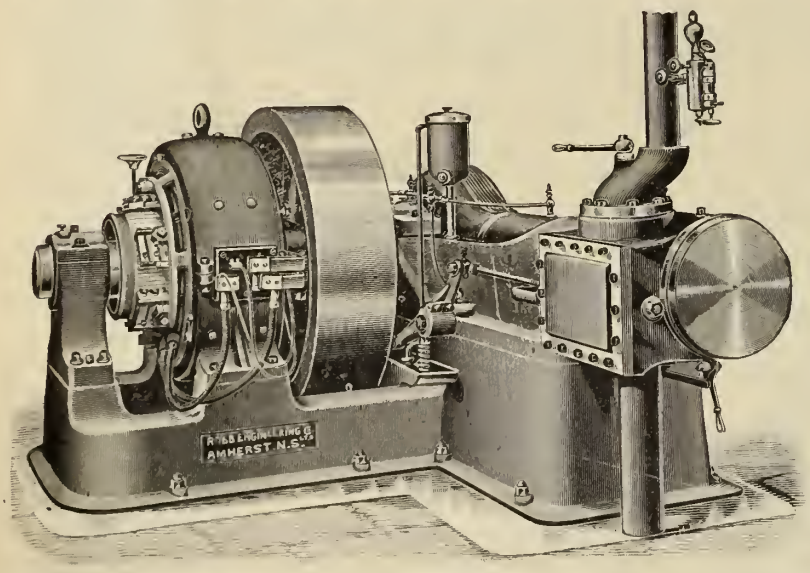

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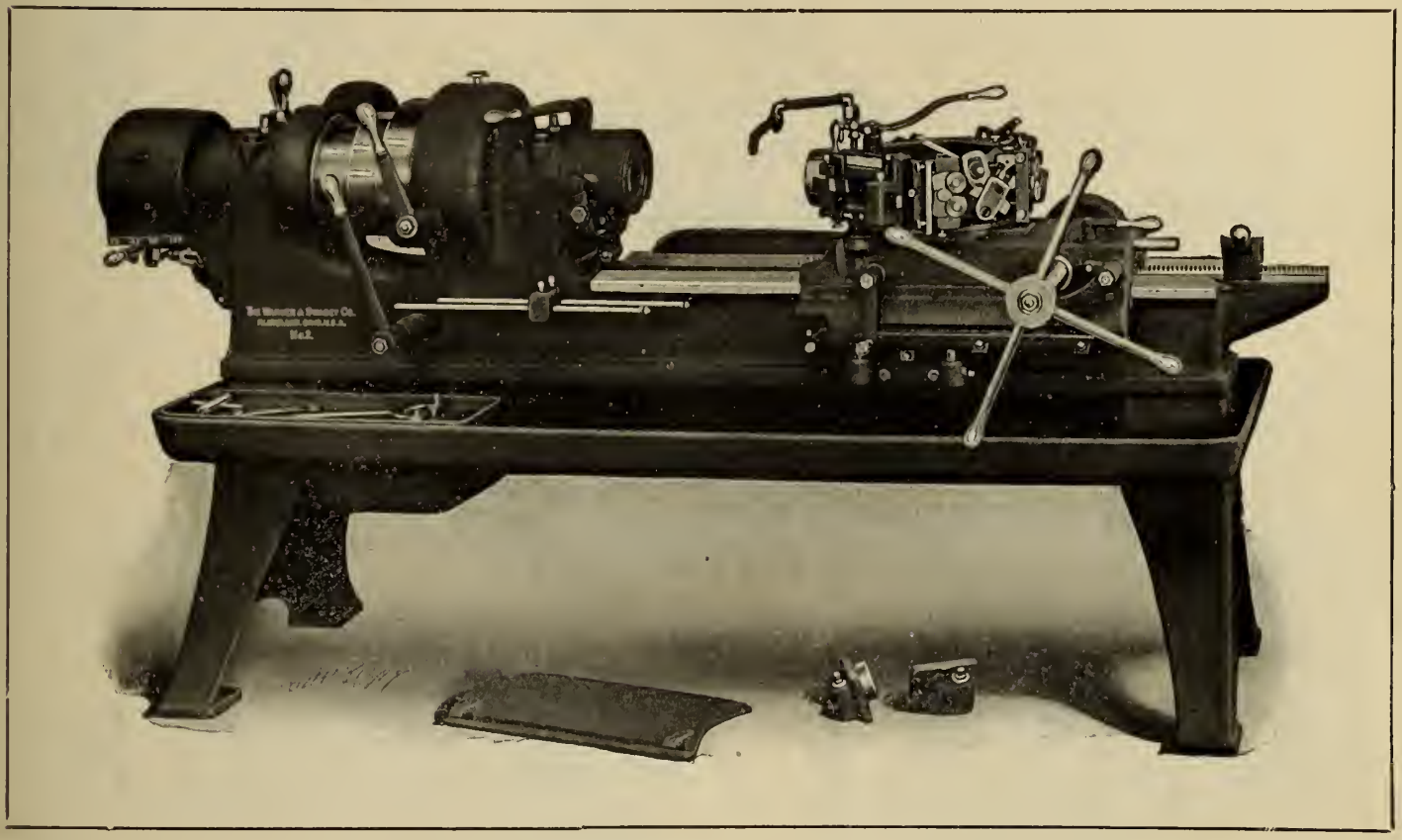

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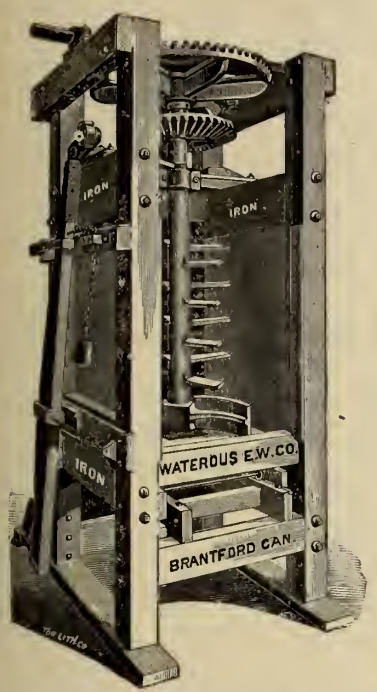

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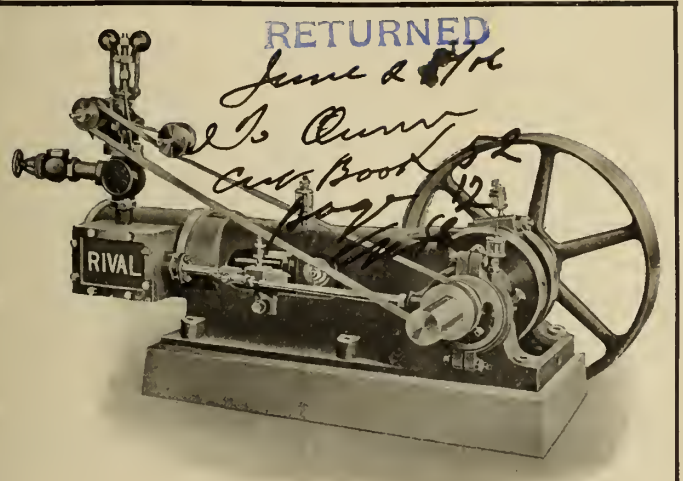

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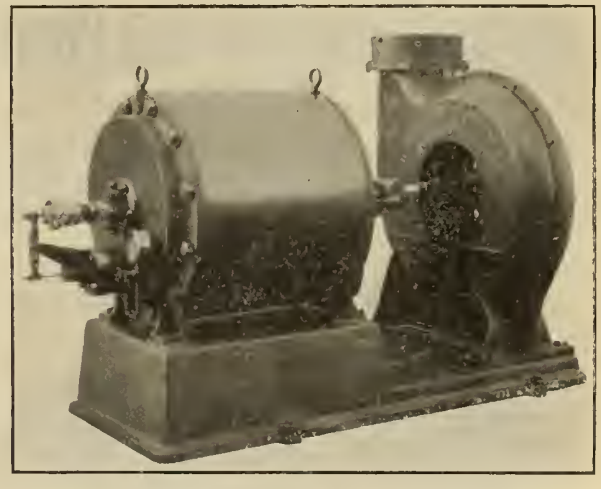

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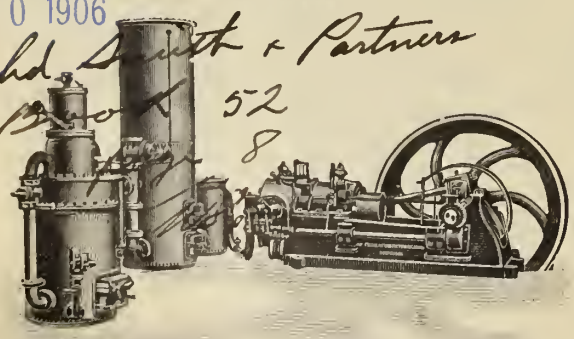

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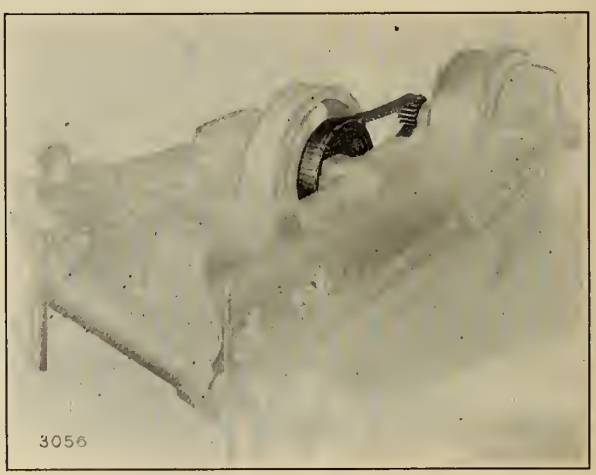

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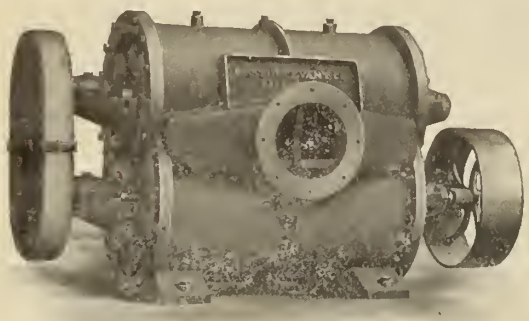

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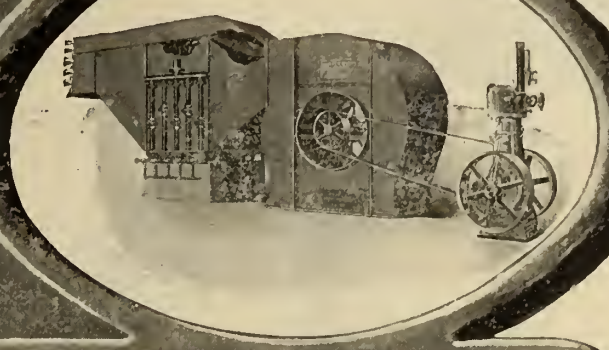

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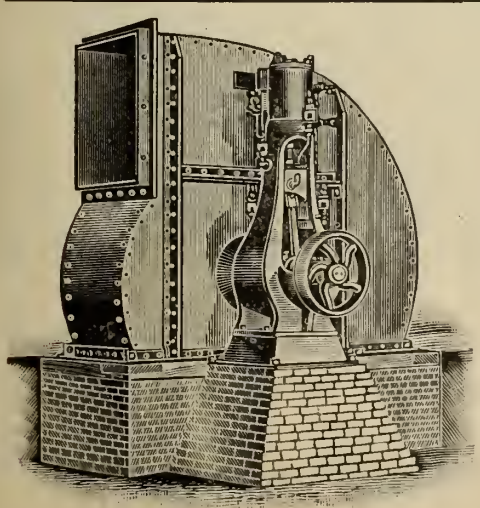

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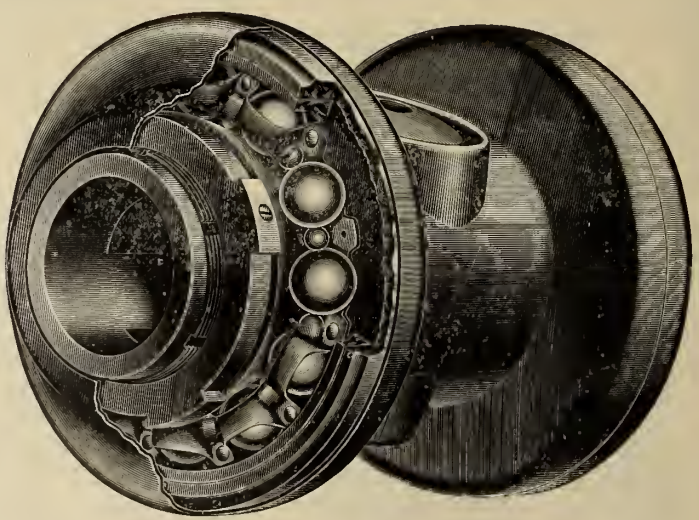
- Wear and tear on belting.
- Danger of Fire from Hot Boxes.



Let us tell you what it will cost to make these savings for you.

THE CHAPMAN DOUBLE BALL BEARING CO. OF CANADA, LIMITED

OFFICE—39 SCOTT STREET. TORONTO.

MACHINERY

WE HAVE ANOTHER LONG LIST TO OFFER, SELECTED FROM OUR PRESENT STOCK

NEW AND SECOND HAND

PERHAPS SOME OF THE FOLLOWING WILL INTEREST YOU:

MACHINE TOOLS

Engine Lathes

1 NEW 36" x 16' London
1 " 32" x 24' "
1 " 32" x 18' "
1 30" x 14' Heavy Bed
1 NEW 28" x 18' London
2 " 26" x 16' and 10' Bed
3 " 25" x 12' and 10' "
4 " 24" from 10' to 18' Bed
3 " 21" x 12' and 8' Bed
2 " 18" x 10' and 8' "
1 Rebuilt 20" x 12', with chuck
8 " 16" x 10', all with chuchs
1 " 18" x 6'
1 " 16" x 6'
3 NEW 16" x 10' and 8' Bed
7 " 15" x 10', 8' and 6' Bed
3 " 14" x 8' and 6' Bed

Cap and Other Lathes

1 NEW 36" x 60" x 16' Gap
1 28" x 40" x 12' Gap, Dundas
2 NEW 24" x 40" x 12' Gap
1 " 24" x 40" x 10' "
1 Rebuilt 20" x 36" x 12' Gap
1 " 18" x 30" x 12' "
1 " 12" x 24" x 60" Gap
1 " 22" x 8' Chucking Lathe
1 21" x 7' Bench Speed Lathe
1 11" x 48" " " "
1 18" x 8' Davis Turret Lathe
1 16" x 6' Brass Finishers' Fox Lathe
1 15" x 4½ Iron Turning Lathe
NEW 11" x 72" Barnes Foot Power Lathe
" 11" x 60" " " " "
Rebuilt 9" x 40" " " " "

Iron Planers and Shapers

60" x 60" x 11' American Planer, with side head
44" x 44" x 17' American Planer
42" x 42" x 20' Putman "
30" x 30" x 8' American "
30" x 24" x 6½' " "
NEW 26" x 26" x 8' Imperial Planer
3 26" x 26" x 7' Rebuilt Planers
One with two heads
NEW 24" x 24" x 6½' London
24" x 24" x 36" Rebuilt Planer
22" x 22" x 6' " "
4 NEW 20' x 20" x 5' London Planers
3 Small Hand Planers
NEW 20" Improved Kelly Shaper
" 20" B.G. Imperial
" 16" Gould & Eberhardt Shaper
" 16" Improved Kelly Shaner
7" Rhodes Hand and Power Shaper

Drilling Machines

2 NEW 100" Plain Radials
NEW 42" Baush Boring Mill, with swivel and Turret heads
" Baush 6 Spindle Drill, with tapping attachment
6 and 4 Spindle Rebuilt Multiple Drills
NEW 31", 28" and 20" Barnes, B. G.
" 16" Reed, Belt Driven
" 13" " 1 and 2 Spindles
2 11" Rebuilt Upright Drills
3 NEW 14" Bench Drills
4 " Small Sensitive Bench Drills
10 Blacksmiths' Hand Drills
7 " " and Power Drills

Presses and Hammers

1 NEW No. 45 Power Press
5 " " 21 " Presses
1 " " 20 " Press
1 " " 19 "
1 Rebuilt No. 19 Power Press
1 NEW No. 16 Power Press
Rebuilt Heavy Stamping Press
Power Draw Press
3 Foot Power Lever Presses
4 NEW F.P. Pendulum Presses
NEW 150 lb. Drop Hammer
" 150 lb. Law Power Hammer
60 lb. Palmer Spring Power Hammer
NEW 50 lb. Foot Power "
42" x 10" Rebuilt Steam Hammer
3 Hand Screw Presses

Punches and Shears

5 NEW 15" throat, London
14" throat, Bertram make
NEW No. 5, Bremer, Single
" No. 4, " Double
" No 2, " Single
" No. 1, " "
" No. 1, " Double
" Bremer Blacksmith's Punch and Shear
Large Power Alligator Shear

Other Machine Tools

NEW No. 1½ Cincinnati Universal Miller
30" x 6" x 16", Stevens " "
27" x 6" x 15" Lincoln Miller
15 NEW Power Hack Saws, capacity 4" x 4" to 8" x 8"
2 Rebuilt Power Hack Saws
5 Iron Frame Keyseaters
NEW 2" Cutting-off Machine
" Phoenix Centreing Machine
2" Bolt Cutter and Threader
1½" " "
NEW 1" Acme Bolt Cutter
4" Curtis Hand and Power Pipe Machine
2 NEW 1¼" to 6" Williams Pipe Machines
NEW 1½" to 2" McDougal Pipe Machines
" 3 Ton Portable Crane
2 NEW 2½ Ton Portable Cranes
Crab Winches and Hoisting Blocks—all sizes
Several Bench and Pedestal Emery Grinders

WOOD WORKING MACHINERY

Wood Planers

3" Heavy Smoothing Planer.
27" Cowan Double Surfacer
27" Double Surfacer, with split rolls
24" Mc. G. G. Double Surfacer
NEW 24" x 9" Surface Planer
Rebuilt 24" " "
" 22" " "
" 24" Pony "
" 20" " "
NEW 24" "Handy" Planer and Matcher
Rebuilt 24" Planer and Matcher
24" Double Surfacer and Matcher
NEW 13" x 7" Lightoing Planer and Matcher
13" Rebuilt Fast-feed Flooring Machine

Buzz Planers

2 NEW 16" Pedestal
1 6" rebuilt
58" Stroke Jointer

Wood Moulders

6" Four side American
8" 3 Side Cowan
7" 3 " all rebuilt
6" 3 " Cant, Gourlay
8" Rebuilt Sash Sticker
6" " " "
5" " " "

Saw Tables

2 NEW No. 1 Clement, Variety
4 " Variety Tables
No 3 S. F. Rip Saw, Ballantyne, nearly new
Rebuilt Combination Table
" Variety Saw, nearly new
" Egan Double Cut-off Saw
NEW Champion Cut-off Saw
Combination Wood Frame Table
Several rebuilt Wood Frame Saw Tables
NEW Improved Iron Frame Swing Saw
Rebuilt Iron Frame Swing Saw
NEW Wood Frame Swing Saw
Rebuilt " " "

Band Saws

3 NEW 36" Pedestal
36" West Side, nearly new
30" Rebuilt Pedestal
26" " "

Re-Saws

Rebuilt 54" Mc. G. G. Band Re-Saw
" 54" J. C. & Co. " "
" 48" Band Re-Saw
" 40" Circular Re-Saw
" 36" " "
Rogers Vertical Re-Saw

Other Wood-Working Machines

NEW Extra Heavy 2 Spindle Shapers
" Standard 2 " "
3 Rebuilt 2 " "
Huh Mortising and Boring Machines
2 NEW Foot Power Mortisers
4 Rebuilt Tenoning Machines
2 Dowel Machines, ¼" to 2", 1¼" to 2¼"
3 Rebuilt Dovetailing Machines
36" Egan Double Drum Sander
3 Box-Nailing Machines
10" x 20" Gordon Wood Printing Press
Several rebuilt Blind Slat Tenoners, Wirers and Borers
NEW 16" Wood Lathe
Rebuilt 18" Wood Lathe, complete
Broom Handle Lathes, Rumblers and Sawing Machines
NEW Wood Trimmers, all sizes

Saw Mill and Shingle Machinery

NEW No. 2 Lane Rope Feed Mill
3 Complete Rebuilt Mills
NEW Tower 2 Saw Trimmer
" " 3 " Double Edger
" 2 Saw Double Edger
3 Set Lumber Car Wheels
NEW Horizontal Saw Shingle Machine
" Upright Swing " "
Rebuilt Horizontal Saw Machine
" Upright Swing
4 Rebuilt Self-Acting Shingle Machines
NEW and Rebuilt Shingle Jointers
Several New Shingle Packers

Water Wheels

26" Right Hand Leffel
25" " " Farrens
23" " " Leffel
21" Burohsm Wheel
20" Left Hand American
18" " " Kennedy
Water Wheel Governor

ENGINES and BOILERS

Horizontal Boilers

63" x 14' with 64 3½" tubes
60" x 17' 6" with 54 4" "
60" x 13' 9" " 84 3" "
60" x 15' 4" " 80 3" "
60" x 12' " 82 3" " NEW
60" x 12' " 83 3" "
60" x 12' " 74 3" "
56" x 14' 4" " 64 3" "
56" x 12' " 60 3" "
48" x 15' 6" " 52 3" "
48" x 14' " 49 3" "
48" x 12' " 53 3" "
44" x 13' " 52 3" "
44" x 12' " 42 3" "
44" x 11' 6" " 43 3" "
38" x 12' " 26 3" "
38" x 10' " 28 3" "
30" x 11' " 24 3" "
2 26" x 16' 4" with 11 3" tubes

Upright Boilers

48" x 10' 6" with 142 2" tubes
36" x 72" " 70 2" "
36" x 84" " 55 2" " NEW
36" x 72" " 55 2" " NEW
36" x 72" " 60 2" "
36" x 72" " 48 2" " NEW
30" x 72" " 43 2" " NEW
30" x 60" " 43 2" " NEW
30" x 65" " 66 1" "
26" x 64" " 37 2" " NEW
24" x 50" " 31 2" "
Also several smaller sizes, New and Second Hand
14 NEW Petrie Special Boilers, at $30.00 each, net

Other Boilers

48" x 72" Fitzgibbon Boiler
44" x 60" Scotch Boiler
48" x 72" Marine, with 121 2" tubes
44" x 52" " 112 2" "
New 40 H.P. Fire Box Boiler
Rebuilt 30 H.P. Fire Box Boilers
" 25 H.P. " "
16 H.P. Waterous Portable Boiler and Engine
25 H.P. Portable outfit on skids
14 and 10 H.P. Traction Engines
13 H.P. Cornell Portable

Automatic Engines

11" x 24" Left hand Corliss
12" x 10" Westinghouse Junor
10" x 15" NEW No. 8 Jewel
8" x 10" " " 5 "
8" x 13" x 18" Taodem compound
7" x 7" Sturtevant, high Pressure, high speed, upright
6½" x 8" Armington & Sims
5" x 7" " "
4½" x 6" NEW No. 1 Jewel

Throttling Governor Engines

20" x 24" rebuilt horizontal
12" x 18" " "
10" x 20" " "
9" x 14" " "
8" x 12" NEW, "

THROTTLING GOVERNOR ENGINES (Cont'd)

8½" x 12" rebuilt horizontal
8½" x 9" " "
8" x 8" NEW "
7" x 14" rebuilt "
6" x 9" " "
5" x 6" " "
4" x 5" NEW "
7½" x 10" " upright
6" x 8" rebuilt "
5" x 7" " "
4" x 4" NEW "
3½" x 5" " "

Marine Engines

12" x 23" x 18" steeple compound
7½" x 14" x 12" " "
4½" x 8" x 6" " "
7" x 14" x 10" NEW, fore and aft
5" x 10" x 6" fore and aft, rebuilt
3½" x 7" x 6" " "
14" x 14" with shaft and 64" wheel
9" x 12" Doty
8" x 8" NEW and complete
7½ x 8" " "
6" x 6" thoroughly rebuilt
4" x 5" NEW

Generating Plant

We offer from stock an outfit as follows: 2 17" x 36" Wheelock Engines; 2 73" x 14' Goldie & McCulloch Boilers; 2 8" x 12" x 12" Condensers, Pumps, Heaters, etc. Also 2 100 K.W., M.P.—4 Generators, Canadian General Electric Co. make.

Gas or Gasoline Engines

One NEW 50 H.P. Ohio
One " 28 H.P. Ohio
One 25 H.P. Junction Engine
One 25 H.P. Brantford "
One NEW 21 H.P. Ohio
One 15 H.P. Pierce Engine
One 14 H.P. Fairbanks Morse
One NEW 14 H.P. Ohio
One 12 H.P. Brantford
One 10 H.P. Haggas
One NEW 8 H.P. Ohio
One " 6 H.P. Ohio
Two " 4 H.P. Ohio
One 4½ H.P. Triton Marine
One 3½ H.P. " "
Also several small Engines

Pumps

1 12" x 7" x 12" Northey Duplex
1 8" x 5" x 12" NEW Duplex
6 6" x 4" x 7" " "
5 5½" x 3½" x 5" " "
9 4½" x 2¾" x 4" " "
6 4¼" x 2¾" x 4" Rebuilt Duplex
10 3" x 2" x 3" NEW Duplex
8" x 5" x 12" Single Acting
7" x 4" x 6" " "
6½" x 4⅛" x 7" " "
6" x 4" x 6" " "
5" x 3¼ x 7" " "
Several Small " "
NEW Morris Centrifugal, all sizes
NEW Taber Rotary, all sizes
3¾" x 8" pedestal plunger pump
3" x 5" " "
2" x 6" " "

Steam Appliances

NEW Pulsometers, Nos. 4 to 7
8 Steam Traps, all sizes
150 H.P. Goldie, McC. Heater
100 " NEW Patterson "
60 " " " "
40 " " " "
50 " " Laurie "
20 " " " "
30" x 96" Heater, also several small heaters

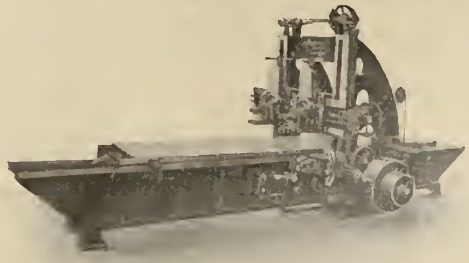
We also carry in stock:

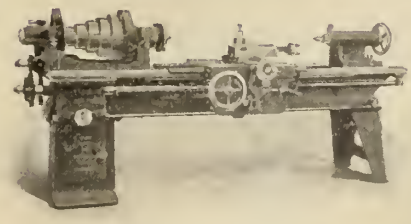
Contractors' Machinery
Electric Motors and Dynamos
Blowers and Exhausters
Laundry Machinery
Printers' Machinery
Grist Mill Machinery
Tinsmiths' Tools

YOU CAN HAVE A FULL DESCRIPTION WITH PRICE ON ANY OF THE ABOVE FOR THE ASKING. HAVE YUU ONE OF OUR LATEST STOCK LISTS?

H. W. PETRIE, Toronto and Montreal

SPEED—ACCURACY





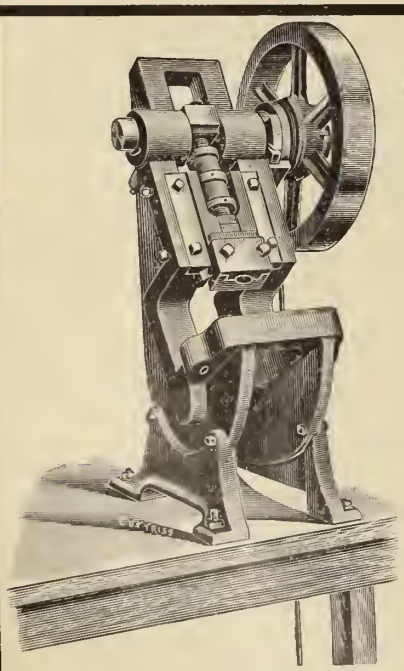
For all purposes, and designed to make good.

These two words combine about everything required of the Modern Machine Tool. There are many points about our Lathes and Planers which need only be shown to be appreciated, and all make for the desired end—Speed and Accuracy, which means profit.

WE AWAIT YOUR ENQUIRIES.

THE R. McDOUGALL CO., Limited

GALT, CANADA



POWER PRESSES

Canadian Made

ALL SIZES

For Stamping of all kinds

Equipped with instantaneous four-point clutch

Also Tinsmiths', Cornice Makers', Metal Workers' and Canners' Machinery.

Manufactured by

Brown, Boggs & Co., Limited

Special Representative:

W. T. STANDISH, - - Toronto

THIS MOTOR DRIVEN MERRELL COSTS YOU NOTHING FOR THIRTY DAYS ABSOLUTELY FREE TRIAL.

It MUST demonstrate its value to you under any and all conditions or we take it back and build you a special one for your special business.

Merrell Pipe Threading and Cutting Machines

thread any size pipe, whether iron or steel, equally well.

The Motor is connected with a double switch so the machine can be run either right or left.

The Gears are all encased; the Vise is self-centering and every machine has our standard adjustable quick opening and closing die-head and improved cutting-off knife.

The Head may be removed from the face and used as a portable hand machine if desired.

Shall we send you a machine on approval?

THE MERRELL MFG. CO., Toledo, Ohio

THE CANADIAN FAIRBANKS CO.,

AGENTS

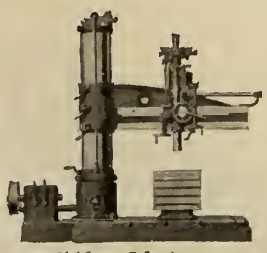
MONTREAL, TORONTO, WINNIPEG and VANCOUVER

MODERN MACHINE TOOLS

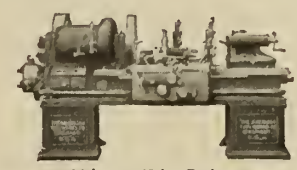
WITH BELT OR MOTOR DRIVE

POWERFUL ***ACCURATE***

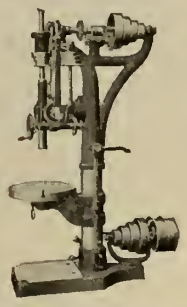
14 in. to 62 in. Swing.
With "Quick Change Gear Mechanism."



2½ ft. to 7 ft Arm.
Driven through Speed Box or Cone.



14 in. to 62 in. Swing.
"Patented" Geared Head (Single Pulley Drive.)

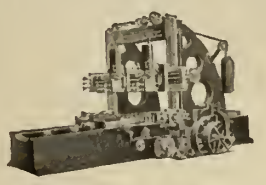


20 in. to 24 in. Swing.
Strong and Accurate.

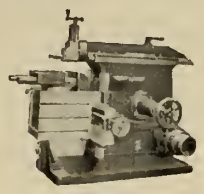
Write direct, or to

H. W. PETRIE, MONTREAL

A. R. WILLIAMS MACH'Y CO., TORONTO



22 in. to 72 in. between Housings.
Single or Variable Speed.



16 in. to 28 in. Stroke.
Highly Geared.

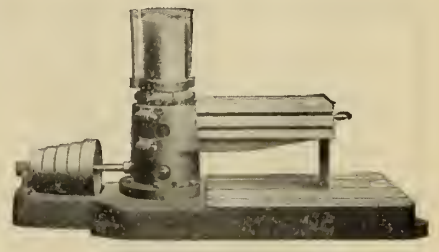
25 in. to 36 in. Swing.
With Geared Feed.

THE AMERICAN TOOL WORKS CO.,

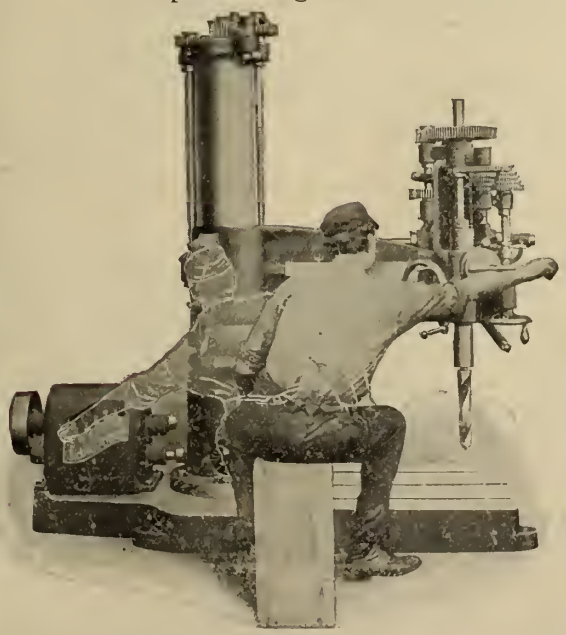
Cincinnati, U. S. A.

Has Greater Productive Capacity

than any Upright ever built—our 30-in. RADIAL DRILL. Costs but a trifle more and is admirably adapted to light and medium manufacturing, being particularly effective in taking care of the ordinary work as found in the average shop.



Cone Drive and Swinging Table



Bickford 30-36"-42" Radial Drill

A Few Features

12 speeds when driven through a speed box ; 10 when a cone is used.

Tapping attachment incorporated in the design of the head.

Fitted with any one of six styles of tables.

Circular 1-A for the asking.

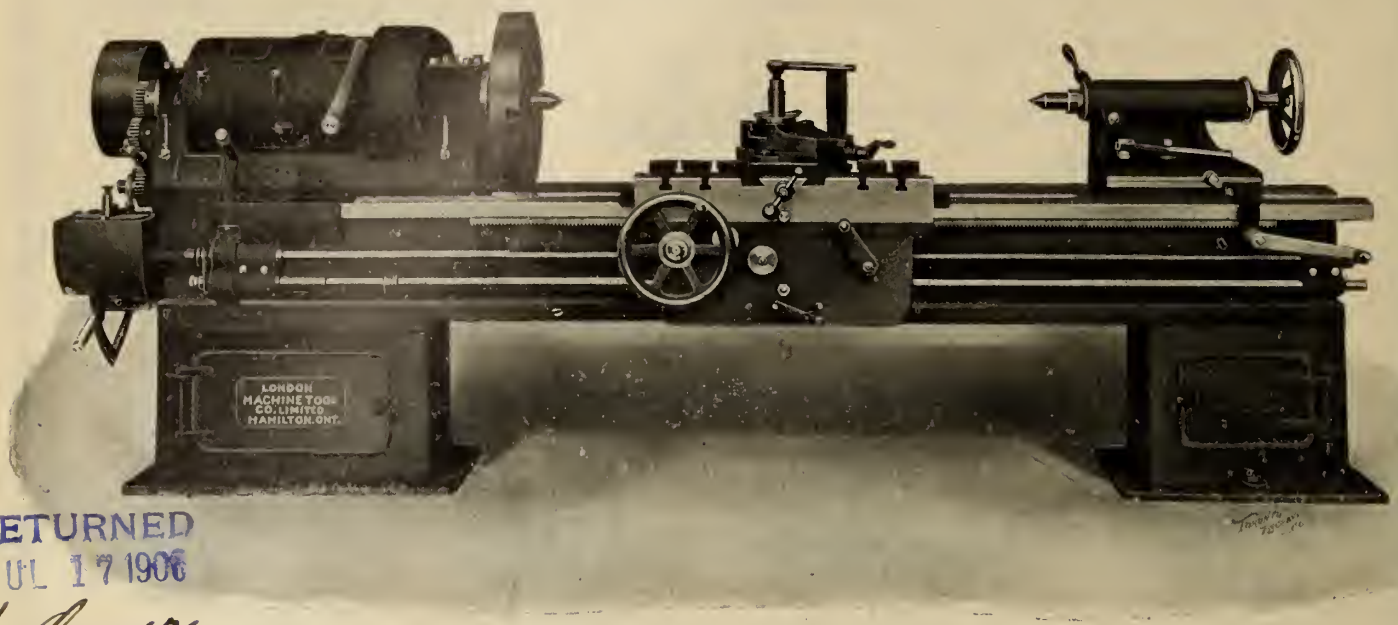
The Bickford Drill & Tool Company

Cincinnati, Ohio, U.S.A.

FOREIGN AGENTS—Schuchardt & Schutte, Berlin. Vienna, Stockholm. St. Petersburg, New York. Alfred H. Schutte, Cologne, Brussels, Liege, Paris, Milan, Bilbao, New York. Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow.

CANADIAN AGENTS—H. W. Petrie, Toronto. Williams & Wilson, Montreal.

LONDON MACHINE TOOL CO., LTD.



RETURNED
JUL 17 1906

J. Turner
Cut Book 5-2
page 1158

New Type, 22 in. All Geared Lathe.

HAMILTON, - ONTARIO

No. 1-14 Cutter and Reamer Grinder.

WE HAVE A FEW OF THESE MACHINES READY FOR IMMEDIATE DELIVERY

This machine is distinctly a cutter grinder, and was designed to fill the want for a machine to sharpen milling cutters of all kinds and shapes, without special fixtures or special-shape emery wheels, being heavy enough to eliminate all vibration and still be easily operated. It weighs about 1370 lbs. The table, which has a long bearing on the saddle, has a longitudinal feed of 20 in., cross adjustment of 7 in., with a vertical adjustment of 6 in. Cutters 1 in. to 14 in. can be taken between centres. The table can be used at different angles with the spindle in horizontal plane, by swiveling the knee around the column. The machine is compact, durable, adaptable and a necessity for the busy shop.

Becker-Brainard Milling Machine Co.

HYDE PARK, MASS.

CANADIAN AGENTS: A. R. WILLIAMS MACHINERY CO., LTD., TORONTO.

The London Works of

The Canada Chemical Manufacturing Company, Limited

HAS BEEN OPERATED CONTINUOUSLY FOR OVER

Forty Years

AND THE SAME HIGH STANDARD FOR QUALITY OF

Acids and Chemicals

HAS ALWAYS BEEN MAINTAINED.

Chemical Works and Head Office **LONDON.** | Sales Office **TORONTO.** | Warehouses **TORONTO and Montreal.**

A "Best" Educator

Time Makes Changes.
We Now Make in Canada

THE **"BEST"** DRY BATTERIES
For
Launches, Autos and Gas Engines, Etc.
No. 6. 2½ x 6
No. 7. 3 x 7

The Berlin Electrical Mfg. Co.
BERLIN, CAN.

GRAPHITE GRAPHITE GRAPHITE

"CANADA GRAPHITE"

Is cheaper than oil;
It smooths the way
For heavier toil.

GRAPHITE GRAPHITE

Its uses are legion: It is especially adapted as a lubricant for Engines, Engine Cylinders, all Bearings, Steam Pumps, Air Compressors and Cylinders, Axles, Automobiles, Gear Cases, Sprocket Chains, Transmission Cables, Elevators, Turn Tables, Valves, Gas and Gasoline Engines and all places where it is desirable to minimize friction. It remains suspended in oil and will feed through any lubricator. A little does the work.

It is a money-saver: Have you read the **story** of Canada's New Lubricating Graphite? **A postal card will fetch you this story and a sample package.** Write to-day.

The Economical Mfg. and Supply Co., Limited

171 QUEEN STREET EAST, TORONTO, CANADA

Manufacturers and Dealers in Power Users' Supplies.

Canadian Agents for The New York Belting and Packing Co., Limited.

GRAPHITE GRAPHITE GRAPHITE

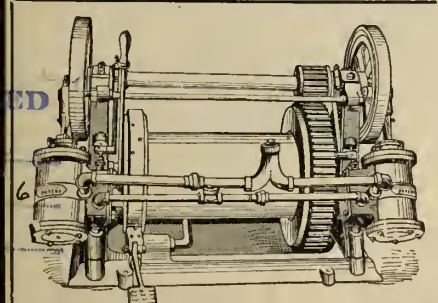
"IT SELLS ON ITS REPUTATION"

There is only one Typewriter of which this has ever been said: the

REMINGTON

Great and enduring is the merit on which such reputation is built.

THE REMINGTON TYPEWRITER CO., 33 Adelaide St. E., Toronto
AND EVERYWHERE.



For Light Hoisting

For Underground Mine Work, Coal Derricks, Steam Lighters, Ice Houses, or for light hoisting work of any description, our 5 x 5 Special Hoisting Engine is unequalled. It is a substantial, compactly built machine, taking up a minimum of floor space, 2' x 3' 6", weighing only 1,200 lbs. and will hoist 1,400 lbs. at the rate of 100 feet per minute.

It is built with Friction Drum and fitted with Foot Brake.

This hoist is extremely popular with large mining companies, and thousands are in use all over the Dominion.

Write for Descriptive Bulletin

THE JENCKES MACHINE COMPANY, LIMITED

Sales Offices—TORONTO, HALIFAX, ROSSLAND, VANCOUVER

Executive Office—60 Lansdowne St., SHERBROOKE, QUE.

Plants—SHERBROOKE, QUE. ST. CATHARINES, ONT.

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SEP 12 1906

MACHINE TOOLS

Electric
Travelling Cranes

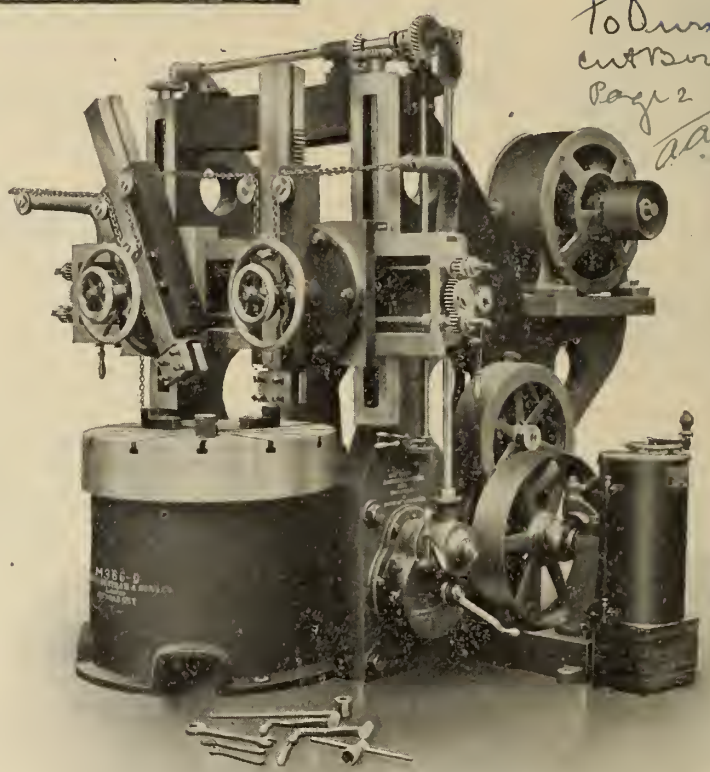
This illustration represents a 100 ton and 25 ton Niles Electric Travelling Crane, with 60 foot span; installed at the Rogers Locomotive Works, Paterson, N.J.

RETURNED
SEP 12 1906
To Dunsmuir
out Bush 55
Page 2
again.

We are Selling Agents for

The John Bertram & Sons Co., Limited
Niles-Bement-Pond
Pratt & Whitney
Brown & Sharpe
E. W. Bliss
J. J. McCabe
R. A. Kelly Co.
Wilmarth & Morman
Merrell Manufacturing Co.
Bignal & Keeler

And other well-known manufacturers.



BERTRAM'S 42 in. BORING AND TURNING MILL, with Motor mounted on back of housing.

THE CANADIAN FAIRBANKS CO., LIMITED

Montreal Toronto Winnipeg Vancouver

Modern Canadian Manufacturing Plants.

ARTICLE XVII.—New Plant of London Machine Tool Co., Hamilton.

INDIVIDUAL Canadian industries are forging ahead, and as a result, Canada is thriving industrially. The machine tool business is one which has made considerable progress of late years and its future appears exceptionally roseate. The London Machine Tool Co. have had their share of prosperity in the past, and are looking forward with enthusiasm to future development. Undoubtedly the machine tool business has a very bright outlook because in the industrial expansion, of which there is such great promise, machine tool equipment is one of the first essentials. At all events, from the size of the present new plant at Hamilton and from the marked facilities for extension and from additions at present being planned, it would appear that the London Machine Tool Co. have ample faith in the future. The new plant is nearly four times the size of their old plant in London, which was burned recently, and from orders already obtained, this year promises to be the largest in the history of the company.

Officers of the Company.

The president of the company is Mr. William Yeates, who has been in the machine tool business for over 25 years, and is probably one of the best known machine men in the Dominion. The general manager is Mr. E. G. Yeates, who is a technical as well as practical man, and the secretary-treasurer is Mr. Roland Yeates. The drafting department is under the charge of Mr. P. M. Yeates. The directors of the company are the above named gentlemen, together with Mr. Geo. F. Webb and Mr. Wm. Southam.

Lay-out of the Works.

The company have eight acres of land situated on the main line of the Grand Trunk Railway and have sidings running into the property. Thus excellent shipping facilities are afforded, and there is plenty of room for extensions. At present the plant consists or a main building 200 feet long and 50 feet wide. From the east side of this main building extend several saw-tooth bays, 84 feet long, with north light. Plans are now being prepared for a 100-foot extension to the main building, with corresponding saw-tooth bays. The buildings are steel construction, foundations being concrete construction and the walls brick, except that the south wall of the main building is a temporary frame construction to allow extensions in that direction. The structural steel was supplied by the Locomotive & Machine Co., Montreal, from designs of Mr. John Lyle Harrington, chief engineer of Locomotive & Machine Co. The roof is of 2-inch tongued-and- grooved hemlock, resting on steel purlins, and is covered with Paroid roof covering made by the F. W. Bird Co., Hamilton. The floor is very substantial in construction. It consists of a 6-inch layer of cinders and slag, then a 4-inch layer of tar concrete; imbedded in this concrete are 4 x 4 inch sleepers spaced three feet on centres, upon which is placed a flooring of 2 x 6 inch tongued-and-grooved hemlock; and upon this is placed a final flooring of 7-8 inch birch, tongued-and-grooved. This constitutes a very smooth and solid floor.

Shipping Department: London Machine Tool Co., Hamilton, Canada.

Shipping Facilities.

The northern half of the main building is reserved for a shipping room. Shipping facilities are of the best, a siding from the G. T. R. running right into the shipping section of the main building. The main building is served by a 25-ton Niles electric crane and the saw-tooth bays are served by smaller pneumatic cranes, from which loads can be transferred to the large one. Thus there is excellent shop communication.

The Machine Shop.

The southern half of the main building serves as a machine shop for the very large work, such as the planing of lathe beds, etc., and also as main erecting floor. Here are situated all the very large tools. The saw-tooth bays constitute the main part of the machine shop. The first bay to the south is devoted to planers and boring mills, while in the next two are placed the lathes, grinders, etc. Two bays are reserved for the erection of the smaller parts, and each is served with a small crane, from which the erected parts can be transferred to the large traveling crane and conveyed to the main erecting floor. Among the machines in operation in the main machine shop may be noticed standard planers of the firm's own make, boring mills, of the Bullard Machine Tool Co. and of the firm's own make, a

line of lathes, made by the firm, ranging from 15 to 72-inch swing, some of them being motor driven. Jones & Lamson

Erecting Floor : London Machine Tool Co., Hamilton, Canada.

turret lathes, Brown & Sharpe & Norton grinders, and Gould & Eberhardt gear cutters, milling machines, etc. Among the larger tools are a 40-foot planer, motor-driven by a 25 h.p. Westinghouse induction motor; two radial drills, one 6-foot arm and the other 4-foot arm, and a 72-inch lathe, all of the firm's own make.

The system of tool drive is a combination of the individual and group drives. The machines in each bay are driven in groups by 10 and 15 h.p. induction motors. Some of the tools that are individually driven are equipped with D. C. variable speed motors and others with constant speed induction motors, the change of speed being obtained in the gear box. The electric traveling crane is equipped with two 30 h.p. and one 10 h.p. D.C. series motors, running on 220 volts.

The Forge Shop.

In one of the saw-tooth bays is situated the forge shop. The air in the shop is kept clear and free from smoke by the down draft forges, supplied by the Canadian Buffalo Forge Co., of Montreal. The fans for these forges are placed high up and out of the way.

Pattern Shop.

A separate one storey brick building, 60 x 36 feet, forms the pattern shop. It is not different from other pattern shops, containing the necessary machinery for pattern making, including a buzz planer made by Clark & Demill, band saw, rip saw, turning lathe, etc. The pattern storage building is a single storey cement construction building, 150 x 40 feet, with wire glass, metallic-framed windows and metallic doors.

Power and its Distribution.

Electric power is received at the transformer station at 2,200 volts, A. C., 2-phase 66 2-3 cycles, and is stepped down to 220 and 110 volts for distribution around the works, the 110 volt circuit being used for the lighting and the 220 volt circuit for induction motors. The transformer house is a brick building, 13 x 17 feet, and contains two 75 K.W. transformers. The direct current required for the D. C. variable speed motors and cranes is generated by a motor-generator set consisting of a 50 K.W. generator coupled to a 75 h.p. induction motor. The switch board is situated behind the motor generator set, and is equipped with all the necessary apparatus for receiving the power from the transformers and distributing it about the shops. The switch board and motor generator set were supplied by the Canadian Westinghouse Co., and the Can. Westinghouse and Canadian General Electric Co. supplied the rest of the motors.

Air, at 80 pounds pressure, is supplied to a receiver by an 8 x 8 Allis-Chalmers-Bulloek air compressor, driven from a line of shafting, and from thence goes to the air hammers, chippers, drills, etc., made by the Canadian Rand Drill Co.

Heating and Ventilating System.

The heating and ventilating system has been found very satisfactory. It is arranged upon the plenum system, and was installed by Sheldons, Limited. The steam is supplied by a 60 h.p. boiler, built by E. Leonard & Sons, at 25 pounds pressure, to a set of steam coils having 7,500 square feet of heating surface. Fresh air is drawn through these coils, and is conveyed to different parts of the buildings through galvanized piping. The fan is 160 inches in diameter and is run by a 15 h.p. induction motor. The office is heated by steam radiators.

Special attention has been paid to the lighting of the buildings, with exceptionally good results. Ribbed glass forms the greater part of the west side of the main building, there being three

Machine Shop : London Machine Tool Co., Hamilton, Canada.

rows of windows with metallic window frames. The roof is supplied with wire glass, metallic framed sky-lights. The northern side of the saw-tooth construction is of ribbed glass. Arc lights for general lighting and incandescent lights for detail lighting, operating upon an A. C. 110 volt circuit, constitute the artificial lighting.

The Molding Shop.

The molding shop has not as yet been built, but plans have now been completed and construction work will be commenced upon it very shortly. The building will be 175 feet long and 100 feet wide, having one central bay of 50-foot span and two side bays each of 25-foot span. The large bay will be controlled by two electric traveling cranes each of 25-ton capacity; and one of the side bays will be equipped with a 5-ton traveling crane.

The Offices.

The most northerly saw-tooth bay constitutes the offices. There is the lobby, the general offices, two private offices and the drafting, photo and blue-printing room. The offices, without being very elaborate in design, present a very handsome appearance. They are finished in Georgia pine and are panelled in dark green and brown.

At present the company are very busy. When the representative of Canadian Machinery went through the plant there were on the floor in the course of construction, a number of large presses, a large punch and shear weighing 40 tons, four horizontal boring machines, hammers, lathes and planers, vertical boring mill, etc.

The extent of the market exploited by the London Machine Tool Co. is shown by the fact that at the time of writing a car of machinery was being loaded for British Columbia, and the day before a carload of lathes had been shipped to England.

A Norton Grinder : London Machine Tool Co., Hamilton, Canada.

CONVENTION CANADIAN ELECTRICAL ASSOCIATION.

AT Niagara Falls, N.Y., on June 19, 20 and 21, the sixteenth annual convention of the Canadian Electrical Association was held. Although there was not the representation that might have been wished, it was a very successful and enjoyable convention. The convention delegates received a warm welcome from the mayors of the two Niagaras at the afternoon session of the first day and the rest of the day was taken up in discussion of three papers and the question box. These papers were: "Engineering Features of Ontario Power Co's Plant," by V. G. Converse: "Engineering Features of Electrical Development Co's Plant" by F. O. Blackwell, and "Engineering Features of Canadian Niagara Power Co's Plant, as Compared with the Original plan on the American side," by H. M. Buck. The paper "Legal Points of Interest to Electrical Engineers," presented by Robert McKay at the morning session of June 20, aroused considerable discussion. The afternoon of the same day was taken up in a visit to the three power plants on the Canadian side, which were discussed in session the day before. A smoking concert in the evening was an enjoyable ending to the day. The paper, "Steam Plant Accessories," by John T. Farmer, and the election of officers, occupied the final session.

President, R. G. Black, Toronto; first vice-president, R. S. Kelch, Montreal; second vice-president, W. R. Ryerson, Niagara Falls; sec.-treas., T. S. Young, Confederation Life Building, Toronto. Executive committee: J. A. Kammerer, Cataract Power Co., Hamilton; J. J. Wright, Toronto Electric Light Co., Toronto; W. Williams, Gas & Electric Light Co., Sarnia, Ont.; Lewis Burran, Quebec Railway, Light & Power Co., Quebec; H. O. Fisk, Peterboro Electric Light Co., Peterboro; J. W. Purcell, Hiram Walker & Sons, Walkerville; B. F. Reesor, Georgian Bay Light & Power Co., Lindsay, Ont.; A. A. Dion, Ottawa Electric Co., Ottawa; L. W. Pratt, Brantford Electric & Operating Co., Brantford; Chas. B. Hunt, London Electric Co., London, Ont.

Manufacturers and supply houses were well represented, among them being the following firms: Robb Engineering Co., New York Insulated Wire Co., Canadian Westinghouse Co., Pittsburg Transformer Co., Allis-Chalmers-Bullock, Canadian General Electric Co., the Wire & Cable Co., the Sunbeam Incandescent Lamp Co., R. E. T. Pringle Co., Mechanics' Supply Co., Standard Underground Cable Co., Packard Electric Co., Oneida Community, Limited, J. A. Dawson & Co., the Philadelphia Electrical & Manufacturing Co., Hamilton Steel & Iron Co., Conduits Co., Limited, Duncan Electric Mfg. Co., E. F. Phillips Electric Works, Rogers Electric Co., Murphy Iron Works, and Hamilton Anchor Co.

The Canadian Westinghouse Company had quite an extensive exhibit of Nernst lamps and other Westinghouse products. The Pittsburg Transformer Co. made an exhibit of transformers, and the Oneida Community exhibited their galvanized chain for arc lamp suspension. The Allis-Chalmers-Bullock printed and circulated, as usual, at four intervals, the "Register" of names of those in attendance, which was a very serviceable feature of the convention. They also exhibited a number of bromide enlargements of some of the machinery installations already made by them, the most noticeable of which was the power-house of the Northern Aluminum Co., where are installed the largest inter-pole generators ever built. The Canadian General Electric Co. distributed a very neat leather pocket note book and card case. A very handsome paper knife was the souvenir given out by J. A. Dawson & Co., Montreal. The Sunbeam Electric Co's souvenir was a very handsome leather pocket book, which was much sought after.

CANADIAN MACHINERY
and Manufacturing News

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, technical progress, construction and improvement, and to all users of power developed from steam, gas, electricity, compressed air and water in Canada.

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NEW ADVERTISERS IN THIS ISSUE:

Dominion Foundry Supply Co., Montreal.
John Bertram & Sons Co., Limited, Dundas.
Warner & Swazey Co., Cleveland.

JUNE'S METAL FEATURES.

CONSUMERS of pig iron have recently confronted a rather unusual difficulty, and one which will tend to somewhat increase the first cost on many of their products. A large proportion of the iron used in this country is of the softer variety, styled number 3. But nearly all the furnaces have been unable to meet orders for this grade during the past month, with the result that even those who had booked their specifications found themselves unable to procure number 3 in quantities sufficient for their wants. The only way out of the difficulty, in many cases, was to purchase harder iron at a cost of about one dollar per ton higher. This condition has been slightly relieved, but number 3 iron has felt its effect and higher prices are now being quoted on that grade by the majority of furnaces.

Among users of machinery the rapid advances undergone by antimony since the first of the year have created much interest, as this metal is an important factor in babbitts, the consumption of which is continually increasing. The normal price of antimony in Canada is about 7 cents per pound, but the present scarcity is such that the hitherto unheard-of figure of 30 cents has been the rule throughout the month of June. It is explained that all the known deposits of antimonial ore are nearly played out, and no improvement in the supply is to be expected until new ones are discovered.

All ingot metals are strong in tone, with the possible exception of tin, which, after reaching the record price of 50 cents per pound, has fallen away to 45. The demand continues very brisk, but it is notorious that the price of tin is always in the hands of speculators, and no prediction is safe. Ingot copper seems destined for higher prices and large buyers state that they are finding it increasingly difficult to buy at the prices quoted in the daily metal reports. Zinc spelter is another metal which is bound to go up. High prices in the European markets have driven foreign buyers to approach American producers and at present the export demand is so great that spot zinc is not obtainable from first hands, and advanced prices are being asked for futures.

All the sheet metals are being liberally inquired for, and both sheet zinc and galvanized iron have experienced higher values during the month. On the whole, the metal market has seldom been stronger than it is at present.

EDUCATION THE BASIS OF PROGRESS.

ALL progress has been due to education, whether general or specific, and so it must continue. The present status of manufacturing and engineering industry is due to the thorough knowledge of men who have done things. Every decade sees the mechanic elevated to a higher plane because of the more intelligent training he has received. Much has been done, but we have not gone far enough. Engineering colleges and technical schools have elevated the standard, but how few mechanics are personally or directly influenced by them!

The men must do much for themselves, and the possibility and practicability of this is shown in the worthy example set by the American Foundrymen's Association, whose convention was held at Cleveland, Ohio, during the first week of June. Following along the lines of the great engineering societies they have gone further than the followers of any other mechanical trade. Their watchword is "education," and the result must be progress. No man or organization can stand still under this condition. Labor troubles are not in their category and collectively they do not know of their existence. Other societies, where time and temper are spent on this subject, might profit greatly by following the example set by the Foundrymen's Association.

In his presidential address delivered at the recent convention Mr. Thomas D. West outlined the association's policy in this connection, showing what had been accomplished and what yet remained to be done. One point emphasized was the need of a more general practical education for those intending to follow a mechanical calling. Apart from this, however, the association—which means the members themselves—has done and is still performing a splendid educational campaign. The spirit of mutual assistance prevails, and knowledge, the result of individual research and effort, is freely circulated and discussed. How different this spirit from the prevailing feeling of half a generation ago when a shop kink or secret was carefully guarded in case a competitor might find it out and enjoy the benefit resulting from knowledge of the same. It betokens a forward movement, a broader and closer fellowship, and a long stride in the direction of fulfilling the golden rule. An association based on such principles with the hearty co-operation of its members possesses potential energy that no outside influence can affect and which cannot but result in being beneficial to all concerned.

THE FINISHING OF MACHINE TOOLS.

IT is undoubtedly true that a handsome appearance goes a long way towards selling a machine tool, whether the purchaser be a mechanic directly interested in the handling of the tool, or whether he be the purchasing agent for a large establishment. There are but few people lacking in that artistic sense that would lead them to look with favor upon a well-proportioned, well-finished machine tool ; and other things being equal, the handsome tool will, in most cases, get the preference, and deservingly so. Without doubt the most important features about a machine tool are absolute accuracy, simplicity of parts and strength to stand the strain to which the tool is subjected ; but while putting all the necessary stress upon these important points, the minor, but at the same time very effective, point of finish should not be overlooked. Fine finishing entails extra expense, and might of a necessity run up the selling price of the tool, but in order to compete with firms turning out finely finished tools, it is found that this extra expenditure is a good investment.

There are two chief features wherein artistic effects can best be developed in a machine tool. These are the proportioning of the tool and the finishing of the castings and machined parts. This proportioning applies to minor parts, such as handles and hand wheels, as well as to the frame or bed of the tool. Putting a fine finish on machined parts is a matter of time and finishing facilities, but the finishing of a casting should be considered in the molding shop. It is probably cheaper to take considerable care in the forming and finishing of the mold, and thus obtain a well-finished casting, than it is to finish a rough casting on the finishing floor.

It might be argued that as long as a tool is accurate, strong, and easily handled, finish does not matter, and that if a tool can be sold for a slightly lower price because of the saving in finishing costs, a common sense purchaser would lay aside sentiment and choose the cheaper tool. This would be so if it were not for the consideration that unless a firm has a very well established reputation for accurate and reliable tools, the purchaser has no guarantee that the tool he is buying is a perfectly accurate and reliable one, and is apt to think to himself that a firm who do not take the time to put a fine finish on their work, are also liable not to devote the requisite time to accurate building. This argument may not be a perfectly fair one to the builder, but the builder has to deal with human nature as he finds it, and therefore has to deal with arguments such as this one.

WHEN THE STEAM ENGINE AWAKES.

ALTHOUGH the internal combustion engine and the steam turbine have come, and have found a place as prime movers, and although the ceaseless water-fall is being made to turn the wheels of industry in a large measure, our old friend the steam engine maintains an unconcerned dignity and throbs on in spite of the intruders. It has many friends and admirers who still believe in it and who, not without reason, have every confidence in its future, for it is looking towards superheated steam and high pressure for release from its present comparatively low economy, and to these it must look for its future existence.

A prominent British engineer states it is a popular fallacy that one of the difficulties arising from the use of superheated steam is connected with lubrication. The difficulties in lubrication are really due to irregularities in superheat. At one time steam containing water passes over the lubricated surfaces, washing the lubricant from those surfaces. This is sometimes immediately followed by over-superheated steam carrying little or no lubricant with it. If the regularity of superheat is maintained the lubricant is not washed away and a small supply of it will suffice.

He believes that the time is coming when we shall use steam engines taking in the steam at 1,000 degrees temperature and at 1,000 lbs. pressure, and expanding this steam through several cylinders, possibly re-heating it in the course of its passage from one cylinder to the other ; and that when we do this, and use the right kind of boiler and the right kind of furnace, we shall be able very probably to cut down our present best figure of 2.9 lbs. of fuel of 12,000 British thermal units to 1.5 lbs., and such a figure will be very hard to beat by any form of internal combustion engine.

RATING OF GAS ENGINES.

GAS engine manufacturers in Canada have not a uniform method of rating gas and gasoline engines. This is to be regretted, for obvious reasons. It is certainly not a satisfactory state of affairs when a 10 horse-power engine from one firm means a 9 horse-power engine from another, and when either engine means actually a 6, 7 or 8 horse-power instead of the 9 or 10 horse-power. If there is any system used in rating the engines it is according to the indicated horse-power, and probably more often than not it is by the size of the cylinder. The only satisfactory way of rating is by brake test, giving the brake horse-power developed by the engine using a certain, or preferably a standard, quality of gas or gasoline. Then a purchaser buying a certain horse-power engine will know that he can develop that horse-power with the quality of gas or gasoline specified, and allowance can be made if that quality is not available.

Gas engines are rated according to brake horse-power by reliable firms in England and on the continent, a brake test being made on each engine before it leaves the works, and it would be greatly to the advantage of purchasers if this method were adopted by Canadian manufacturers.

MANUFACTURERS GETTING TOGETHER.

WHAT should lead to one of the greatest industrial organizations in the world was commenced by the combined Boards of Trade of Niagara Falls, Ont., and Niagara Falls, N.Y., when they recently invited representatives of the manufacturing interests from Canada and the United States to meet and visit the various works on both sides. It is proposed to make this an annual affair, but in which the manufacturers as a whole will be in closer connection. With an annual meeting of this kind where the manufacturers of the two great countries are brought in close contact, questions of mutual and reciprocal interests should be discussed. Matters of tariff and questions concerning methods and materials of manufacture could be brought up and agreements arrived at as to most advantageous methods for the industries of both countries. With the manufacturers of the two countries in unison on certain points the respective Governments could hardly fail to listen favorably to petitions from them, provided they were in harmony with the interests of the masses. Now that the matter has been fairly launched it should not be allowed to drop, and those who took the initial steps should see to it that a great organization is effected having for its object the discussion of broad industrial problems, conducted after the same manner as the great engineering societies.

American Foundrymen's Association

The Eleventh Annual Convention — Interesting Exhibits of Foundry Machinery, Equipment and Supplies a Feature

A JOINT convention of the American Foundrymen's Association and the Associated Foundry Foremen was held at Cleveland, Ohio, June 4 to 7, and proved to be the most successful in the history of the organizations.

Associated Foundry Foremen.

While this was held in the armory, commencing on the 5th inst., the business session of the fourth annual convention of the Associated Foundry Foremen was held at the American House the evening before with President David Reid, of Hamilton, Ont., in the chair. Apart from the regular business of the association the most noteworthy feature of the meeting was the unanimous decision by the members present for the closest adherence to the constitution, which stated that its objects be solely educational and that any local organization not conforming to this be adjudged in bad standing and forfeit its charter. Officers were elected as follows: Hugh McPhee, Eaton, Cole & Burnham Co., Bridgeport, Conn., president; Hugh McKenzie, American Shipbuilding Co., Cleveland, first vice-president; A. T. Williams, Enterprise Mfg. Co., Philadelphia, second vice-president; F. C. Everett, J. L. Mott Iron Works, Trenton, N. J., secretary and treasurer.

Joint Meetings.

The Cleveland armory, in which the meetings were arranged for, was devoted along both sides and ends and for some space in the main building to the numerous and attractive exhibits of various foundry machinery and supplies.

At the opening meeting, Thomas D. West, the president, gave an interesting address on "The Need of a Practical Education," which was both inspiring and instructive. Following the reports of the president and secretary-treasurer, a paper by W. K. Barrows, Sharpville, Penn., on "Influences of Different Ore Mixtures on the Resultant Pig Iron from the Standpoint of the Foundrymen" was read. At the afternoon session the secretary read the following papers: "The Beneficial Effects of Adding High Grade Ferrosilicon to Cast Iron," by A. E. Outerbridge; "Twenty Years' Improvement in the Quality of Pig Iron," by E. H. Williams and E. R. Sanborn; "Development of the Thermit Process in Foundry Practice," by W. M. Carr, and "Foundry Tests of Coke," by Dr. Moldenke. Other papers read were "Recent Methods of Machine Molding," by E. H. Mumford, and "Good Molders: Why They are Scarce," by M. S. McQuillan, South Norwalk, Conn. In the evening the visitors were entertained to a vaudeville at Keith's theatre, being the guests of the local committee.

At the Wednesday morning session N. W. Shed, Buffalo, read an address on "Foundry Fluxes," and Dr. Richard Moldeke made a report on "The Testing of Coke Made by the U. S. Fuel Testing Plant at St. Louis."

Other papers presented were: "A Modern Pipe Foundry," by H. A. Croxton, Massillon, Ohio; "Comparative Designs and Working of Air Furnaces," by Ralph West, Sharpsville, Pa.; "Multiple Molds," by James K. Webb, Elkhard, Ind.; "Electricity in the Foundry," by F. L. Antisell, Perth Amboy, N.J.; "A Talk on Alloys," C. Vickers, Milwaukee; "Toilet Room and Sanitary Applianees for the Foundry," by Henry M. Lane, Cleveland, Ohio.

In the afternoon the delegates were taken on special cars to the plants of the Brown Hoisting Machinery Co., the Wellman-Seaver-Morgan Co., and the Electric Controller & Supply Co., followed by a visit to the Case School of Applied Science where the afternoon session was held.

On Thursday the party journeyed to Lorain, a thirty-mile trip by boat, where the final meeting of the association was held, the occasion being a visit to the works of the National Tube Co. A paper was read by D. M. Loudom on the subject of "Ore Mixtures and Compounds." On the subject of "Costs" papers were presented by Kenneth Falconer, of Montreal, his topic being "Uniform Practice in Foundry Cost Finding" and "The Correct Application of True Burden to Iron Costs," by E. M. Taylor, Boston.

The officers elected were: President, W. H. McFadden, McIntosh, Hemphill & Co., Pittsburg, Pa.; secretary-treasurer, Dr. Richard Moldenke, Watchung, N.J. Vice-presidents: New England, 1st district, C. J. Caley, Russell & Irwin Mfg. Co., New Britain, Conn.; New York and New Jersey, 2nd district, John W. Burr, Brook & Houston Co., Brooklyn, N.Y.; Pennsylvania, 3rd district, Stanley G. Flagg jr., Stanley G. Flagg & Co., Philadelphia; Ohio and Illinois, 4th district, J. H. Whiting, Whiting Foundry & Equipment Co., Harvey, Ill.; Michigan, 5th district, W. J. Keep, Michigan Stove Co., Detroit, Mich.; Minnesota and Wisconsin, 6th district, Thomas Sheriffs, Sheriffs Mfg. Co., Milwaukee, Wis.; Southern States, 7th district, J. B. Golden's Foundry & Machine Co., Columbia, Ga.; Canada, 8th district, L. L. Anthes, Toronto Foundry Co., Toronto.

The retiring officers and members of the Cleveland entertainment committee were extended hearty votes of thanks. A rising vote of thanks was also given Dr. Richard Moldenke, secretary-treasurer of the association, for his untiring efforts on the organization's behalf.

On invitation of the Philadelphia Foundrymen's Association it was decided to hold the next meeting at the city which will in all probability be followed by a meeting in Toronto the year after.

A smoker embodying unique features was held in the armory. Apart from the vaudeville entertainment, which was provided, interest was centred around a large cupola of the Whiting Foundry Co. Chicago, from which liquid refreshment was drawn and served by waiters from foundry ladles. Each guest was provided with a souvenir stein, tobacco pouch and pipe, supplied by the association, while Mr. Geo. H. Wadsworth, of the Falls Rivet & Machine Co., presented each with a leather cigar holder containing a number of high-grade smokes.

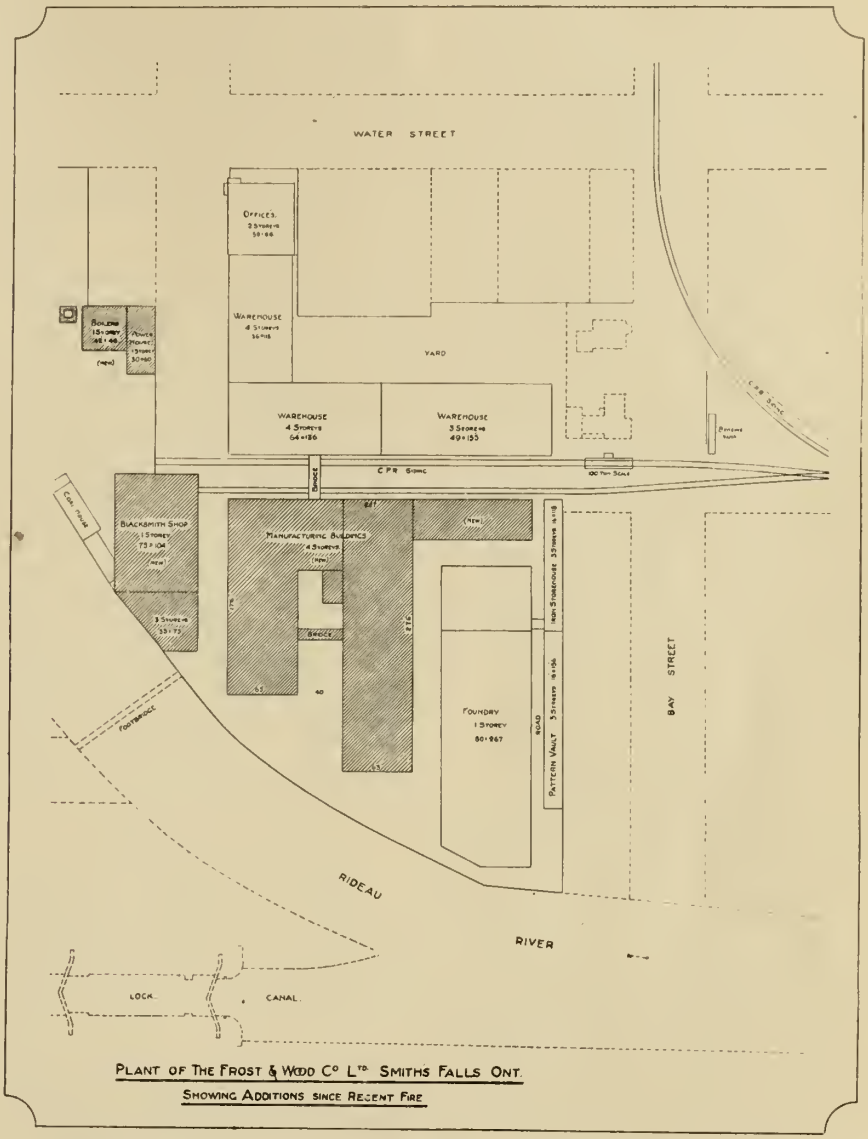
The Exhibition Feature.

Much of the credit for the unparalleled success of this convention is due H. M. Lane, editor of the Foundry, who worked in a ceaseless manner to complete and bring to a successful culmination the various events and features of the convention, which showed not only a large amount of planning, but much executive ability. An association was formed with a view to making the display of foundry supplies and equipment a permanent feature of the convention, called the American Foundrymen's Supply Association. The officers elected were: President, S. C. Johnston, Chicago; vice-president, C. H. Mumford, Philadelphia; 2nd vice-president, E. A. Koepler, Pittsburg; secretary-treasurer, H. M. Lane, Cleveland.

The exhibitors included:

American Sand Co., Columbus; molding sands; represented by F. A. Downard and A. R. Tingle. Arcade Mfg. Co., Freeport, Ill.; molding machines; represented by F. N. Perkins. Atlas Car & Mfg. Co., Cleveland; industrial tracks and railroad equipment; represented by

T. A. Williams, jr. Berkshire Mfg. Co., Cleveland; molding machines in full operation; represented by R. H. York and A. N. Battenfeld; souvenir, paper weight. Adam Brandon, Detroit; fireproof molders' shoes; represented by Adam Brandau. Bruce-Meriam-Abbott Co., Cleveland; 55 h.p. gas engine in operation; represented by A. E. West. Buckeye Milling Co., Cleveland; dry core compound; represented by R. A. Tidball. Buckeye Sand Co., Pittsburg; molding sands; represented by Ira E. Bixler and Walter Rutson. Chicago Pneumatic Tool Co.; chipping hammers, sand rammers, air compressors and hoists; represented by C. T. Smith. Chisholm & Moore Mfg. Co., Cleveland; chain hoists and I-beam trolleys. Cleveland Chaplet & Mfg. Co., Cleveland; wrought iron chaplet and chaplet stems; represented by W. A. Cronenberger. Cleveland Wire Spring Co., Cleveland; steel "tote" boxes; represented by J. W. Campbell. Connersville Blower Co., Connersville, Ind.; blowers; represented by R. T. Huston. Crystal Fluorspar Mining Co., Cleveland; lump gravel and ground fluorspar, lead and zinc. E. A. Dempwolf & Sons, York, Pa.; hydrofluoric acid. Detroit Foundry Supply Co., Detroit; galvanized rim riddle and foundry supplies; represented by E. J. Woodison, L. A. Crandall, W. K. Beers and W. Bruce Howard. Diamond Clamp & Flask Co., Richmond, Ind.; snap flasks and clamps; represented by W. N. Gartside. Wm. Dobson, Canastota, N. Y.; molders' tools; represented by Wm. Dobson; souvenir, aluminum rule. Electric Controller & Supply Co., Cleveland; lifting magnet in full operation; represented by W. A. Ten Winkle. Falls Rivet & Machine Co., Cuyahoga Falls; core room equipment; represented by George H. Wadsworth; souvenir, cigar case. Goldschmidt Thermit Co.; exhibition of welding by the thermit process; represented by Ernest Stutz and A. M. Guenther. Harbison-Walker Refractories Co., Pittsburg; fire brick and cupola blocks. Herman Pneumatic Machine Co., Zelienople, Pa.; jarring molding machine; represented by H. C. Herman; Holland Linseed Oil Co., Chicago; core compound; represented by C. B. Baumgartner. Interstate Sand Co., Cleveland; molding sands; represented by H. C. Koontz, F. E. Gordon, L. K. Brown, E. M. Ayres and V. E. Kenavel; souvenir, leather card case. W. W. Lindsay & Co., Philadelphia; chaplets and anchors; represented by J. I. Fasy; souvenir, paper weight. C. E. Mills Oil Co., Syracuse, N.Y., represented by H. E. Mills and W. E. Baird; souvenir, trick match box. Monarch Engineering & Mfg. Co., Baltimore, Md.; Harvey metal melting and refining steel furnace, rivet heating furnace, blowers and air compressors; represented by James V. Martin. Municipal Engineering & Contract Co., Chicago; represented by W. J. Rosebery, jr. J. S. McCormick Co., Pittsburg; foundry supplies; represented by T. E. Malone; distributed handsome booklet. S. Obermayer Co., Cincinnati; foundry supplies; represented by E. D. Frohman and S. T. Johnson; souvenir, postal card. Osborn Mfg. Co., Cleveland; foundry brushes, mallets and other supplies; represented by E. F. Streich; souvenir, clothes brush. E. H. Mumford Co., Philadelphia; molding machines; represented by E. H. Mumford and J. H. Rathbone. Thomas W. Pangborn Co., New York; foundry equipment and supplies; represented by J. B. Bothan. Republic Belting & Supply Co., Cleveland; belting and supplies; represented by S. C. Cutler. W. W. Sly Mfg. Co., Cleveland; cinder, tumbling and resin mills and dust arresters; represented by W. W. Sly; souvenir, pocket book and cigar case. J. D. Smith Foundry & Supply Co., Cleveland; Blundell pneumatic sand shaker and foundry supplies; represented by J. S. Smith, P. S. Smith, Milton Finley and Fred A. Coleman. Standard Sand & Machine Co., Cleveland; mixers, dryers, screens and elevating machinery for foundry; represented by H. G. Boughton and W. H. Smith. B. F. Sturtevant Co., Boston; high pressure blowers; represented by W. H. Coleman. Tabor Mfg. Co., Philadelphia; molding machines; represented by J. W. Dopp. Western Foundry Supply Co., East St. Louis, Ill.; ground ferromanganese and foundry supplies; represented by J. A. Rogers; souvenir, one pound bags of ground ferromanganese. White Tool & Supply Co., Cleveland; pattern making, tools and equipment; represented by F. C. White. Whiting Foundry & Equipment Co. Harvey, Ill.; Whiting cupola; represented by S. T. Johnston.



Plan Showing General Scheme of Frost & Wood Plant at Smith's Falls, Ont.

MACHINE SHOP EXTENSION.

In the last issue some details of the large new machine shop of the Frost & Wood plant at Smith's Falls were given. Herewith is shown a diagram of the new works, the general plan of which will be readily seen. Everything connected with the new plant and its equipment is to be of the most modern type.

Antimony and its Uses

By James G. Lorriman.

IN view of the ever-increasing consumption of antimony, and the threatened depletion of the world's supply, it seems remarkable that there are very few men, even in the business of selling that metal, who are familiar with its nature. But now that its price has reached four times the normal quotations a greater interest in the subject is being aroused, and an anxiety is shown to learn more about antimony in order to more thoroughly understand market conditions.

Antimony is a white and very brittle metal which, so far as known, is not used in the pure state, but is valuable as forming several valuable alloys and compounds. It is a peculiar product, as deposits of the crude ore are not found in the same way as lead, silver and the other better known metals. Antimonial ores are not deposited in strata which can be traced and their probable output estimated. On the other hand, they are discovered in mere pockets, which are liable to play out at almost any time.

Nature of the Ore.

The chief ore from which antimony is derived is the sulphide, which is known as stibnite or grey antimony, and which, when pure, carries 71.4 per cent. of metallic antimony. A considerable proportion of the world's output is also furnished by another ore, called stibiconite, or antimony ochre, which is an oxide, and contains 74.5 per cent. of antimony. The process of smelting and refining these ores to produce antimony regulus, the standard form in which the mineral is used, is a very complex and expensive one. It depends very largely upon special conditions, which prevent the exploitation of some small deposits of the ores in countries other than those which now furnish the chief basis of supply.

Sources of Supply.

The largest known deposits of antimony are in Spain, Portugal, and certain parts of South America. There are some small deposits of ore in Nova Scotia, but these have never been exploited. The Chinese have not been mining their ores for some time past, consequently it has been difficult, if not impossible, to purchase any quantities of the metal in Japan, practically all the Japanese antimony being refined from Chinese ore. Whether the wily Chinese are, for commercial reasons, husbanding their resources until prices have gone even higher, or whether their deposits are actually playing out, is something that Europeans have been unable to find out. It would not be surprising to learn that this latter is the case, for beyond a doubt all the other known deposits of antimony are being very rapidly exhausted, and already an end to the supply is seen. As a matter of fact, the production in 1905 was more than fifty per cent. lower than in 1904.

No substitute for this metal has ever been devised. As has been shown, the visible supply is being depleted at an alarming rate, and to accentuate the difficulty many new uses for the metal are being found. The whole question now hinges on the possibility of discovering new deposits of the ore. The pockets have not only to be found, but also developed, so that at the least another year must elapse before the present situation is relieved.

Uses of Antimony.

As has been mentioned, antimony is used solely in the form of alloys and compounds. Its chief importance arises from the fact that it hardens lead and kindred metals. It is largely used for britannia, pewter, babbits, and type metals, perhaps the largest proportion being consumed in these products. But increasing quantities are being purchased by the leading governments for war ammunition purposes, including the manufacture of smokeless powder and the hardening of bullets. The Japanese used large quantities during the recent war, and a severe drain was made upon the market within the past few weeks, when the Russian Government placed orders for about six hundred tons.

Antimony Prices.

In considering the figures quoted on antimony since the year 1900, we have all the more cause to wonder at the remarkable flight which began last Fall, and has not yet reached its limit.

The current price in Montreal for January, 1900, was 10¼c., with the market very quiet. During the next several months conditions were slightly better, and 10½c. was the price quoted. The latter part of October developed a little flutter which sent the price to 11 and 11½c., but it declined to 10c. in November, and the year closed with this figure ruling.

In 1901 the situation throughout was even quieter than in the preceding year, the price of 10c. being maintained steadily, with the exception of ½c. advance in April. The year 1902 opened with quotations still 10c. per pound. In October the market weakened, and the price declined to 9½c., while November witnessed another slump of ½c. A temporary recovery to 10c. was effected in the early part of December, but 9c. was again the price quoted at the end of the month.

In the year 1903 the price of 10c. was steady during the first half, but a falling off occurred during the closing months, so that January, 1904, showed a price of 8c. In May a slight weakening was noticed, the minimum price declining to 7¾c., which became the ruling quotation in June. Another drop in July resulted in a price of 7½c. being given, and this was maintained until the middle of November, when a startling advance in the Old Country boosted the Canadian quotation to 9¼c.

The opening months of 1905 showed little change in this price. In February the price given was 9½c., and there it remained until May, when there was a decline of ½c. About the middle of June the beginning was made in that period of advancing prices which still continues. Prices climbed steadily until September, when the record price of 16c. was obtained. A temporary weakness then developed, quotations falling off to 14¾c., and finally to 14c., which was the figure quoted at the close of the year. At the very beginning of the present year figures began to soar, and a steady upward movement has been continued ever since. The price now is hovering around 30c. per pound—just about four times the figures quoted but two years ago.

Nor can we hold out much hope of altered conditions in the near future. Even if new ore deposits are found promptly it will take at least a year to develop them, and in the meantime prices must be arbitrary and well nigh prohibitive. No orders are now being taken by the leading Canadian merchants for delivery earlier than September, and even at that the import price is such that jobbers will still be compelled to ask from 30c. a pound up. Indeed, very little surprise will be felt if 35c., or over, is reached.

Trade Paper Advertising

By Converse D. Marsh

IT is easy enough for anyone to record the fact that trade paper advertising has made material advances during the past ten years, and has made specially marked improvement during the past five years.

I do not believe that, notwithstanding all that has been done, a tithe of what is possible has been accomplished.

House organs flourish; special methods of advertising have increased appropriations to the detriment of the trade press, and back of all this, the large manufacturers throughout the country—capitalists who control—give scant attention to the question of trade paper advertising, and secretly have little respect for it, nor do these prime factors in the advertising appropriations believe that their interests can be materially advanced by liberal publicity in the chosen organs of their trade.

The impulse of every large publisher will be to rise up and dispute this statement, but if he does so, let our friend, the disputant, review the fact that trade paper advertising expenditures by our large manufacturers are but minute, fractional portions of the total sum expended for selling the factories' products.

In several instances of which I have knowledge, the large manufacturing corporations spend, for advertising appropriations, less than one-tenth of one per cent. of their gross sales!

Large fortunes are being made by publishers in the field of general publicity, while comparatively small ones are earned by publishers in the specialized or trade journal field.

The makers of the popular magazines can complacently cross their legs and say that this is not only as it should be, but that it is inevitable, while, on the other hand, trade paper publishers do not seem to have had the spirit to make matters better for themselves. They, too, believe that the comparatively small position that they occupy is a reasonable one.

Things are not reasonable, merely because they exist.

The complacency of the big brother may be all right, but I do not believe the acquiescence of his financially lesser kindred is.

A little seething unrest should stir the gentle soul of the trade-paper owner.

Why should the monthly, or weekly, created to amuse people, be a wonderful money maker while mainly it advertises cheap, inconsequential things, while the trade paper, the serious exponent of heavy financial interests, is relegated to an obscure corner in the congregation of publications?

The popular magazine reaches hundreds of thousands where the trade paper reaches tens of thousands, but the goods offered for sale, and really sold, through the influence exerted by many trade papers, largely exceeds the volume of trade sold through the influence of the prominent, popular magazines.

If Postum Post was at the head of some great steel company, wouldn't we see the fur fly in the advertising he did, say in the Iron Age or the Engineering Record?

If the General Electric Company was owned by the Uneeda Biscuit crowd, what a serious factor advertising in the Electrical World would become.

In the steel and iron business of this country I venture to say that the proportion spent in advertising to influence sales would be but an infinitesimal part of one per cent. of the amount of the sales.

Without the means of breaking into the archives of the gentleman who is swaying American breakfast destinies from the magical precincts of Battle Creek, I do not think I will be gainsaid in my estimate that nearly one-half of his total revenue is expended for publicity.

The sales of the General Electric Westinghouse, and the Allis-Chalmers interests alone, in the electrical world, must in combination represent over one hundred millions of dollars per annum.

I wonder, if the gentlemen controlling these electrical giants combined, are spending the insignificant sum of fifty thousand dollars per year with the trade papers?

Can it be that the seller of trifles, logically should spend hundreds of thousands of dollars, whereas, the really large business interests, having a much wider field, think they have exhausted the possibilities when they have expended a few pitiful thousands?

Does the reason for this lay accusingly at the door of either the trade paper publisher, or his customer, or should the burden of accusation be shared impartially by both. Somebody has got to shoulder it.

To my mind, neither the publisher, nor his advertiser, have yet grasped the latent opportunities that exist in trade paper publicity. It is the duty of the publisher to show these possibilities to the manufacturer if the latter cannot spare the time to study them himself.

In some lines, one single trade publication reaches practically every buyer in the field—every man who can influence an order—and yet the advertiser with millions of dollars of possible sales, is content to merely play with the trade paper advertising proposition.

What likewise shall be said of the lack of advertising by the thousands of smaller manufacturers of machinery who could be benefited even more than the few large manufacturers by a greater amount of, and more intelligent, publicity?

Speaking broadly, I don't believe that the presidents and board of directors of our average manufacturing corporations, give five minutes' heed a year to trade papers, or what the trade papers can do for them. They are content to spend a few thousand dollars in advertising account and let it go at that. They show that they have no respect for their publicity departments, because the salaries of the managers of such departments are invariably the lowest paid heads by many thousands of dollars of any departments maintained, and the advertising counsellor is indeed a rara avis.

They think enough in other directions about making sales, but no single force in the trade paper field has yet grappled with them, struck them squarely between the eyes, and made them sit up and take notice that a great force was at their door—a wonderful force and factor that could be utilized in increasing their sales. Because in the multitude of their duties the heads of manufacturing organizations omit any consideration of advertising, will the publishers of the trade press be content to maintain the position allotted them?

Let the trade paper brother gird up his loins, and himself carry the war into Africa, if I may be allowed to so quickly shift my suggestion.

In plain, practical, every-day English, I would say that it is up to the trade paper publisher to himself devise selling plans through publicity, and bring them to the attention of his customers, big and little.

Then too, let him make his reading columns more attractive to the real people who buy the kind of goods that his advertisers have to sell. This makes an abrupt termination but it contains enough of thought to induce me to cease writing.—Printer's Ink.

Chemical Action in Boiler Feed Waters

By J. A. DeCew, Chemical Engineer

IF water were simply a compound of hydrogen and oxygen, as its chemical formula represents, the difficulties and troubles which so often arise when it is put to industrial use could never exist.

Water in nature produces the chemical phenomena of corrosion and detrition, and in processes of manufacture a like phenomena is often reproduced, which has as one of its final results, explosions. Water in forming seizes hold of the various surrounding atmosphere constituents and before it reaches the earth it has already absorbed a considerable amount of oxygen, nitrogen, carbonic acid, nitrites and ammonia. Aided by these dissolved gases, and especially the carbonic acid which it continues to accumulate, this rain water attacks the mineral constituents of the earth over which it passes, and is able to carry in solution a portion of the more soluble salts with which it has come in contact. A substance showing such vigorous action in nature is not necessarily dormant in industrial use, and as experience has shown, it is sometimes able to get away with substances which have a maximum of resisting power.

A water charged with carbonic acid gas has a strongly corrosive action on limestone rocks, the gas holding just so much of the rock as will combine with it to form calcium bicarbonate. If the gas is taken out of the water by any means, the limestone drops out of the solution again and when this occurs in nature, a new limestone rock is formed. In industrial operations the result is exactly similar, for if we remove the gas by boiling, the limestone rock, not being able to escape with the vapor, must remain in the boiler, and attaches itself firmly to the surfaces with which it comes in contact.

This process is well exemplified in nature, in the stalagmitic deposits of limestone caves where layer upon layer of stone is formed by the gradual percolations of lime-charged waters.

Not only does water dissolve limestone rocks, but also compound carbonates, such as dolomite, which is a carbonate of calcium and magnesium. If the quantity of calcium carbonate held in solution exceeds .5 gramme per litre, the water is called a carbonate water, and the readiness with which this salt is precipitated forbids its use in many industries.

Waters generally carry more than carbonates in solution, especially when they come in contact with beds of gypsum or pass over a limestone carrying pyrites. In the latter case the sulphur becomes oxidized to sulphuric acid, and attacks the limestone, forming calcium sulphate, which then dissolves in water. Such waters are generally known as sulphate waters, when the proportion of calcium sulphate is over .20 grams per litre. The limit of solubility of calcium sulphate in water is reached at about 2 grams per litre. This is a factor which varies with conditions, however, for the presence of alkaline chlorides or nitrates will increase the solubility of calcium sulphate, and its solubility also increases with concentration. On the other hand, the presence of carbonic acid or sodium chloride will decrease its solubility.

There are many other salts that find their way into natural waters, such as the chlorides, calcium, magnesium and sodium, sulphides, sulphites and nitrates. These are either corrosive or incrusto-corrosive, and offer many dangers and difficulties when we endeavor to use them for steam production. When the acids are not present themselves in the free state, they are often liberated from their combined condition by the interactions and decompositions which take place amongst these salts under the energizing influence of temperature and pressure.

Corrosive Waters.

That waters containing free sulphuric, nitric or hydrochloric acid are dangerously corrosive is a fact generally recognized. But that their corrosive action is continuous and the salts they form when neutralized by the iron of the boiler are also very corrosive, is not so generally understood.

By way of illustration let us follow the chemical changes that take place through their cycle of reactions.

$3\ Fe\ Cl_2 + 4\ H_2\ O = Fe_3\ O_4 + 6HCl.$

$2\ HCl + Fe = FeCl_2 + 2H.$

$6\ FeCl_2 + 3O = 2Fe_2\ Cl_6 + Fe_2\ O_3.$

$Fe_2\ Cl_6 + 3H_2\ O = Fe_2\ O_3 + 6HCl.$

We thus see that whether the ferrous chloride becomes oxidized or not, we have as a final product the hydrochloric acid with which we started, and a deposit of oxide of iron.

What difference will it make, therefore, in the chemical results if we start with the ferrous chloride in this cycle of reactions instead of the hydrochloric acid itself?

Ferrous sulphate and ferrous nitrate produce analogous reactions.

Chlorides.

Other chlorides may enter this corrosive cycle of operation by indirect means, on account of the fact that they are readily decomposed. Magnesium chloride is one of these, thus $MgCl_2 + H_2\ O = 2HCl + MgO$. The hydrochloric acid is then ready to begin its work.

Sulphate of magnesium is a salt which in itself is harmless to boiler plate, but in the presence of a chloride it becomes actively corrosive. If we let the former XCl represent any chloride, then $MgSO_4 + 2\ XCl + H_2\ O = MgO + X_2\ SO_4 + 2HCl.$

We get a corresponding sulphate and hydrochloric acid again. When chlorides and magnesium carbonate meet in a boiler, we arrive at a similar result.

Rather an unexpected reaction is that which takes place between sodium chloride and silica in presence of steam. $SiO_2 + 2NaCl + H_2\ O = Na_2\ SiO_3 + 2\ HCl.$

This shows what may happen in boilers using sea water, or where salt is used as a curative agent.

Amongst the corrosive sulphates we may mention sulphate of alumina and sulphate of copper. Under the influence of heat, either of these substances will liberate free sulphuric acid, in the first case basic sulphate of alumina being deposited, and in the second case metallic copper.

Sulphides.

The sulphides of the alkalies and alkaline earths are easily decomposed under certain conditions into the oxide of the metal and sulphuretted hydrogen, the latter becoming finally oxidized to sodium thiosulphate, commonly known as hypo. The reaction may be expressed as follows:

$4Na_2\ S + 4H_2\ O + O = Na_2\ S_2\ O_3 + 6Na\ O_4 + H_2\ S + S.$

Hydrogen sulphide may also be formed in the steam boiler by the reducing action of organic matter on any sulphate present.

$CaSO_4 + 4C = 4CO + CaS.$

The calcium sulphide decomposes, liberating hydrogen sulphide, which then becomes oxidized to sulphuric acid. The sulphuric acid then sets up the cycle of corrosive reactions already described.

Sulphites.

When sulphurous acid or sulphites obtain entrance to a boiler, they are not long under the action of the steam until they are oxidized to sulphuric acid. When ferrous salts, the sulphurous acid will reduce them to the ferrous condition and liberate the acid at once.

$$Fe_2\ (SO_4)_3 + H_2\ SO_3 + H_2\ O = 2FeSO_4 + 2H_2\ SO_4$$

The dangerous possibilities of this reaction are too evident for further comment.

It is a generally known fact that water often carries quantities of nitrates which it has dissolved from the soil. But this is often overlooked in inquiring into the causes of corrosion. Ferric nitrate is particularly corrosive, for in reaction with other salts, its nitric acid is set free. Chlorides and nitrates together may result in the like action of both HCl and HNO_3, and the results of this "aqua regia" may be readily imagined. A table of the reactions which produce acids in a boiler is a long one, and these would only indicate the beginning of the corrosive chemical changes.

The results of this chemical activity all tend to build up new business for the boilermaker, and therefore cannot be considered a universal evil, although the number of lives yearly sacrificed in the change from the old boiler to the new is a factor which should be of some importance.

The reason that so little thought is given to this subject by many steam users is that the complexity of the problem is not apparent, and when a remedy is applied it is generally an overhead treatment which is applied to all cases alike, without regard to chemical reactions which will take place in the boiler or the resulting products.

A proper solution of any problem of this kind cannot be obtained without first obtaining a knowledge of the chemical constituents contained in the water, and then the work has just begun.

Very little has been said in this article regarding the effects of incrustation which often take place simultaneously with corrosive action, but this aspect of the question has been so generally discussed that further reference to it is almost unnecessary.

There are very few manufacturers now who feel like paying for 20 per cent. of lost fuel when a remedy can be found for this leakage.

Tendencies in the Foundry Industry *

Economy of Room.

APART from the use of molding machines to turn out larger numbers of castings cheaply, there is a noticeable tendency to economize shop room, and hence molds are piled as high as they can be conveniently poured. It may be objected that this method oftentimes produces more sprues per pound of casting than the old way, and that if trouble comes a stack of molds will be ruined instead of only a single one. Yet this system has been found to pay wherever tried, and the getting of more tonnage for a given floor space is bound to spread. The idea, however, should be followed out to its logical end wherever work is made of sufficient quantity. This would seem to be the stacking up of the molds in fairly deep foundry pits, the iron being wrought in large ladles by traveling crane, and poured from the bottom of the ladle. Suitable variations in the method can naturally be devised for given cases, but the idea remains the same; to get the greatest tonnage for a given floor space, in order to save investment and cost of output.

Preparation of Molding Sand.

Greater attention will ultimately be given the preparation of the molding sand. Our European brethren are far ahead of us in this respect, every foundry of importance grinding its sand to a given standard, then passing it through mixers which incidentally fill the perfectly uniform material with a maximum of air, thus cushioning the sand and keeping it as open as it may be. When a highly refractory molding sand is used, this treatment assists in turning out the smoothest kind of work. As our consumers are constantly harping on better looking work, this point might be considered more carefully by American foundrymen. Many sands are exceedingly uniform in their natural state, as, for instance, the well-known "Albany," the result being highly finished castings, where the best molding methods are employed. On the other hand, who does not recognize a "Pittsburg" casting; that is, one made in the sand dug in the inviron-ments of the smoky city. Judicious sand treatment would go a great ways to remedy the difficulty even here, did the good people make the class of work current in the eastern states. What great differences may exist in molding sand in the same heap may be seen in an exaggerated way where sand conveyors are in use. Here, unless special precautions are taken, the loamy particles in the sand may get together, leaving the silicious portions without a binder. The result is that copes drop out, scabs are formed, etc.

Accessories and Standards.

Before leaving this branch of our subject, we must not forget to mention the growing tendency to perform as many operations about the foundry as possible by mechanical means. We have now some excellent examples of what may be done in this way in our advanced foundries. Whether it be the mechanical charging of the cupola, the mold and sand conveyors, metal distribution, compressed air attachments, yard cranes, and the like, the tendency is to be encouraged as much as possible, as whenever the manual labor of several men can be replaced by the brains of only one, conditions of management are much easier to meet. The investment may become higher, but competition can be better met, and as a general proposition the resources of the nation are employed to its greatest advantage.

Perhaps this is as good a place as any to mention the growing demand for foundry standards. Thus flasks, pattern work, and the molding methods depending upon the close co-operation of the pattern shop with the molding floor, are coming in for considerable attention. The makers of molding machines will be greatly benefited by this desired standardization of flasks, for the time has now gone by when a manufacturer would go out of his way to get the most impossible screw thread in order that the repairs subsequently necessary would have to some to him. We shall undoubtedly see the day when all the designs of the drafting office of an industrial establishment will go for revision to its foundry superintendent in order to standardize the non-essential elements therein and create less labor in producing the castings.

We owe much to our high-class custom pattern shops for the progress they have forced upon the pattern end of our industry. It is not so long ago that metal patterns were unheard of in many foundries. It seemed like a waste of good money to put more time and effort on a pattern than was required by the ordinary article we all have piled on our pattern shelves. However, this tendency is growing steadily, and many a shop to-day can boast of a set of metal cutting machines which remind one of a first-class tool-room. This tendency is, however, closely interwoven with the specialization of the foundry, and where a first-class man is in charge the pattern storage room becomes less of a graveyard for obsolete material.

*A paper recently read before the New England Foundrymen's Association, by Dr. R. Moldenke, gives a survey of modern practice, part of which is given.

*Industrial Future of Central Canada**

By Thos. R. Deacon, Winnipeg

"I want to say something about Central Canada, and for my purposes I shall call that part of this country lying between the meridian of North Bay, and the base of the Rocky Mountains, Central Canada. I wish to make a few remarks on the present and the future of this part of our country and some particular reference to Winnipeg. Owing to the fact that prior to the building of the Canadian Pacific Railway, that part of Central Canada lying east of Lake of the Woods was absolutely unknown and unsurveyed territory, no importance was attached to it, and since the completion of that road so great has been the development in the better known and older sections of Canada and the capital and energy of the country has been so completely utilized to their industries and the exploitation of their resources that little opportunity has been afforded to take stock of the potential resources of the part under discussion, and in fact it is only recently that serious attention has been turned that way. And yet, gentlemen, I desire to express it as my sincere conviction that from the fountain of that great wilderness will spring a lasting stream of material wealth that, dividing into two great branches, the one flowing east and the other west, shall rival the agricultural wealth of the west or the industrial wealth of the east.

Exploring New Ontario.

"In 1900 the then premier of Ontario, Hon. G. W. Ross, decided to have an exploration of that part of the country called New Ontario made, and accordingly sent out ten parties, each one in charge of a practical surveyor and including a geologist and expert timber estimator. The net result of their exploration fully justified the most sanguine expectations in regard to the natural wealth and fertility of the country. A clay belt comprising an area of at least 16,000,000 acres was discovered, nearly all of which is well adapted for cultivation. This almost unbroken stretch of good farming land, is equal in size to the twenty-two counties of old Ontario, lying west of the County of York in a line drawn from Toronto to Midland, which portion of Ontario was shown at the last census to be inhabited by a population of 1,081,000 people. This clay belt was found to cover an area as large as the States of Massachusetts, Connecticut, Rhode Island and Delaware combined and about half the size of the State of New York, or half the size of England. It was found to be remarkably well watered by numerous rivers, the principal of these being the Moose, flowing into James Bay, and its tributaries, the Abitibi, Metagami, Missanabie and the Albany, with its tributaries; the Kenogomi and Ogoki. Including all areas of good agricultural land in what is called New Ontario there is found to be 20,000,000 acres, or 125,000 farms of 160 acres each, capable of supporting a population of 1,000,000 people.

Thos. R. Deacon, Winnipeg
Manager of the Manitoba Iron Works.

Climate is Mild.

"The climate, which is the necessary accompaniment of any lasting colonization, has been found to present no obstacle to successful settlement. The vegetables found growing at the Hudson's Bay Company's posts were a living evidence of the possibilities of successful agriculture. Even at Albany post the potato tops were green on Sept. 25. On Oct. 3 the garden produce had not been removed from the ground for the Winter at Albany post. Only two nights of frost were observed up to Oct. 28.

"From careful estimates made it has been found that there is still in the crown unsold in Ontario white and red pine, which will produce at least 6,000,000,000 feet of lumber, which at present prices has a cash value of not less than $42,000,000 on the stump, which if invested at only 3 per cent. would net the province an annual income of $1,260,000. It was found also that extensive forests of spruce, jack pine and poplar existed, estimated to contain 300,000,000 cords of pulp wood, which at 40c. per cord would give the province an annual income of $3,600,000 for all time to come. From a very conservative estimate of the annual growth of pulp wood, it is found that it amounts to no less than 6,000,000 cords, or sufficient to employ 200 pulp mills continually, employing 100,000 men.

Mineral Wealth.

"I have so far spoken only of the agricultural and forest wealth of that portion of Central Canada lying east of Winnipeg; let me give you a few facts as regards the known mineral wealth, as this is more likely to have a direct bearing on the City of Winnipeg. I will briefly mention first that deposits of nickel in the Sudbury district have been found upon development to be practically inexhaustible. By means of diamond drills half a dozen of which have been used day and night for some years in one locality, millions of tons of high-grade nickel ore has been blocked out and large bodies of ore located, upon which no development has yet been done. As regards the cobalt, nickel, arsenides and silver deposits in the Temiskaming district, I am indebted to a recent report of the Bureau of Mines for some valuable information regarding this discovery. The archaean protaxis or that rocky region which stretches away from the St. Lawrence River, expanding to the northwest, is producing a group of what may be called unique or, at least, comparatively rare minerals. The nickel mines of Sudbury, which is one of the two important nickel producing localities of the world, produces with the nickel and copper, the bye-products, platinum and palladium. The corundum deposits of North Hastings and South Renfrew now supply by far the greater part of

* An address delivered before the Canadian Club of Winnipeg.

the corundum used in the world and the recently discovered cobalt, nickel and arsenides of Temiskaming district have suddenly acquired an importance as a producer of cobalt, which is only rivalled by the deposits of Saxony. As to what we may reasonably hope for from the building of the Grand Trunk Pacific road through that new region, let me remind you, gentlemen, that these great cobalt, nickel and silver deposits were discovered by the building of the Temiskaming & Northern Ontario Railway within a short distance of the shore of Lake Temiskaming, which has been a well-traveled water route to the north for over 200 years, and the Sudbury deposits were discovered by the building of the Canadian Pacific Railway. These two instances show the possibilities there are for the discovery of important mineral bearing areas in the vast hinterland of Ontario. The latest report from the Bureau of Mines of Ontario, which keeps a close record of all matters pertaining to mining in the province, show that there have actually been shipped from Cobalt already. $3,500,000 worth of silver alone. At the Pan-American exhibition at Buffalo in 1901, twenty-one awards were made to the Ontario exhibit, viz., three gold medals, seven silver medals, six bronze medals, and five "honorable mentions," a larger number than the exhibit of any state or country save Mexico alone.

Iron Deposits.

"I have yet to mention, so far as we are directly concerned, the most important of all, viz., the iron industry. A large number of very extensive and very valuable deposits of iron have been discovered in the Lake Superior region, and I have recently learned that the largest single deposit of iron ore known in the world has recently been located in this district. The iron and steel industries are the foundation of our modern civilization. To realize our dependence upon them, try to imagine what the state of affairs would be if our iron and steel industries were swept away. Transportation by railway and boat would cease; the machinery in our factories would be banished, and the comforts and luxuries of our life destroyed. We might better do without silver or gold.

"It has now been proven that the vast deposits of iron ore in Canada known these many years, but hitherto considered valueless because of their high sulphur contents, may now be utilized by the use of water power for electric smelting, with which the country is richly blessed, and this means that Central Canada can undertake for herself this basic industry of modern civilization without having to import coal or ore for that purpose. Using entirely Canadian products Canadian manufacturers will be able to make the tools and agricultural implements for the settlers pouring into the country; will be able to build the bridges and boats and railways which are required to open up still other new territories and make the machinery to be used in thousands of busy factories.

Winnipeg Should Profit.

"How does this affect Winnipeg? Shall she become really a manufacturing city of importance, with solid, stable industries, or shall she be content to remain an aggregate of people living on commissions skimmed from the stream of agricultural products flowing eastward and the tide of manufactured articles flowing westward to supply the territory to the west. That depends. Other centres with various advantages and ambitions will no doubt spring up as rivals to draw trade away and new routes may be opened up which may deflect a large part of the stream of commerce from Winnipeg.

"It is a fundamental law of the political economy of manufacture that institutions which are engaged in the production of finished goods should be located as nearly as possible, having due regard for the conditions of production, in close proximity to the point of consumption. And because the principles of that law have been misapplied it has become the habit to regard Winnipeg as a point unsuitable for manufacturing. I believe I can demonstrate that this is a fallacy and that within a very short time it will be amply shown that Winnipeg is most fortunately placed, and that once her public men are thoroughly awakened to her opportunities an era of development and expansion and solid industrial growth will dawn, the full effulgence of whose glorious noontide no man would dare predict. We live in the electric age and Winnipeg is within easy distance of an enormous source of this form of energy.

"I have for some time been giving a considerable amount of thought to this question, and a short time ago I made a rough computation, erring on the safe side, of the amount of energy available at this city from a single source, namely the Winnipeg River. I do not wish to be tediously technical; you all know that the Winnipeg River drains an immense area of country stretching from far south in the State of Minnesota, north of the Canadian Pacific Railway, and extending eastward from the Lake of the Woods, at least 200 miles.

Water Power Available in Winnipeg.

"The basin of the Lake of the Woods is over 25,000 square miles in extent. Now, all the water that can, by any possibility, flow down the Winnipeg River in any single year is the amount that has been precipitated as rain and snow for a corresponding length of time. Observation has shown the amount precipitated over this area to be about 30 inches annually. Probably one-quarter of this is lost by percolation into the soil and utilized for plant growth, one-quarter may be re-evaporated, leaving 50 per cent. to flow by conduction down the Winnipeg River. The fall from the Lake of the Woods to Lake Winnipeg is about 355 feet. A computation of this volume of water falling 355 feet gives the enormous total of 1,097,000 horse power as the potential energy of the Winnipeg River between the Lake of the Woods and Lake Winnipeg. Fairly efficient turbines will develop 80 per cent. of the potential energy of a fall and this gives us 882,000 effective horse power available for work. Allowing the extreme of 25 per cent. for loss in various ways, we still have over half a million horsepower available for actual use, which, I believe, the genius of the Canadian engineering profession is quite competent to deliver to the wheels of commerce in our factories.

"But we must have raw material, they say. Very good. Pig iron and wheat are the basis of all commerce in these days and we are planted right in the midst of the future sources of these commodities.

"I firmly believe, and I want to go on record as having expressed this opinion, that the building of the new Grand Trunk Pacific will be followed by discoveries of iron ore gigantic in extent, and this opinion is based, not on mere mental impression, but on sound scientific deductions. I feel that northwestern Ontario is on the eve of a tremendous mineral development, particularly in iron, copper, nickel and silver ore. Large smelters will be erected to smelt by electricity, using the powers of the Kaministiqua, the Nipigon, the

Michipicoten, and other rivers, and from this source Winnipeg will have her supplies of raw material.

"Our market is at our doors. Planted on the very shore of a golden ocean of waving grain fields, dotted with innumerable archipelagoes of prosperous homesteads inhabited by a people rich from the products of the soil, our material prosperity cannot fail to be very great. Since the advent of human life on this planet men have sought the end of the rainbow under which is hidden the pot of gold, and suddenly the world has learned that it rests upon the earth in the wheat fields of Western Canada, and the multitudes have set their faces thitherward. If we are the worthy sons of our sires we will avail ourselves of this heritage and continue to demonstrate to all the world that Canadians are as bold in conception, as intelligent in design, and as skilful in execution as any other race.

"Canadian brawn and Canadian brain have achieved things in the past, and have overcome difficulties that to a less vigorous people might seem insurmountably stupenduous. But our reward is near if we but devote our energies to building up our manufactures side by side with our agricultural development, not in conflict, but in harmonious combination, so that all the various occupations of our people shall be interwoven for the general good of all, so that all shall be peacefully and happily employed in the various acts of agriculture, commerce and of manufacture."

*Experiments on Strength of Cast Iron Machine Parts**

By Prof. C. H. Benjamin

CAST iron and steel are to-day the most important materials in the manufacture of machinery, iron for frames and for those parts which are exposed principally to compression, steel for the simpler shapes which carry the tension and strain. Cast iron is a material notably weak in resisting tension and for that reason it is more or less an uncertain quantity where bending is concerned.

In so simple a thing as a cast iron beam of rectangular section theory is more or less at fault in predicting the safe load. A series of experiments which I conducted several years ago showed me that the neutral axis of such a section was not stationary, but traveled gradually up from the centre of gravity as the load increased. As the sections become more complicated the stresses due to the uneven cooling begin to appear and to still further embarrass the designer.

I long ago came to the conclusion that as far as this material is concerned we must obtain our formulas and take to experiment. Accordingly, in the past dozen years I have conducted tests in the laboratory of the school on a great variety of cast iron members to determine the actual breaking load or pressure and compare it with that deduced by theory. There were tested in this way beams of various sections, cylinders, wheels, flat plates, gear teeth, pulley arms and rims, fly wheels, rotary discs and high speed pulleys of various types.

The tests on the cast iron beams of various sections were made in 1901 and 1902. Experiments on the bursting strength of cast iron cylinders similar to those used in steam engines have been carried on from time to time. It has been found that such cylinders usually break in a circular line just back of one of the flanges instead of splitting, as theory would indicate. Furthermore, the failures occur at pressure less than one-half those given the usual formulas for their shells. This is probably due to pressure of blow holes or hot spots at the junction of shell and flange and to the bending moments caused by the pull of the cover bolts. Subsequent tests on cylinders whose flanges have been reinforced by brackets substantiate this conclusion.

The cylinders all split from end to end under a pressure approximately two-thirds that given by the formula for their shells. The other third is accounted for by the bending due to lack of uniformity in the metal. A cylinder 10 x 20 inches, with a 3-4 inch wall, would burst at a pressure of about 1,400 lbs. per square inch, corresponding to a tensile stress of 10,000 lbs., whereas tensile tests showed the metal, a soft grey iron, to have a tensile strength of 14,000 lbs. The bursting of several of the cylinder heads under the pressure suggested the idea of testing flat plates in a similar manner.

At this point Prof. Benjamin was asked to state the manner in which the cylinders upon which the experiments were made were cast. He said he was not advised what method was used, but several of the foundrymen believed that the blow holes below the flange could be easily avoided if properly cast.

Continuing, he said: Both rectangular and square plates were tested and the results were found to be remarkably uniform. The bursting pressure varied less than 10 per cent. from that calculated by accepted formulas. The tests on gear teeth were made by applying a steady load on the testing machine, and were only conclusive as to the selection and not the absolute strength of different forms. The pressure was applied at various angles of obliquity, from 0 to 30 degrees, and two pitch involute and cylindrical teeth were selected for experiments. The shapes varied from those of pinions to those of racks, and the following conclusions were reached:

1. The plane of fracture is approximately parallel to the line of pressure, and not necessarily at right angles to the radial plane.

2. Corner breaks are likely to occur even when the pressure is uniformly distributed.

3. Rack teeth are about twice as strong as those of pinions of 15 to 20 teeth, and involute teeth are from 40 to 50 per cent. stronger than cycloidal.

The breaking pressure corresponded quite well to those calculated from the modulus of rupture of the iron used. There is reason to believe that teeth in service which have a less strength than indicated by static experiments would have substantially the same relative strength as those indicated.

In testing the arms and rims of pulleys a steel belt was used and a twisting moment thus applied to the pulley through the medium of levers and a testing machine. The pull on the tight side of the belt was graduated to twice that of the slack side, and the pulls were increased until one or more of the arms failed. The arms were slightly tapering and had twice the strength at the hub as at the rim. The fact that they broke sometimes at one end and sometimes at the other showed the ratio of the bending moments. The arm or arms nearest the tight side of the belt nearly always failed first, and we were justified in forming the following conclusions:

1. That on account of the springing

* From an address delivered before the delegates to the Convention of the American Foundry Foremen at Cleveland.

of the rim the bending is unevenly distributed, so that about twice the average moment comes on the arm nearest the tight belt.

2. That the bending moment at the hub is about double that at the arm, as such pulleys are usually designed. The above ratios will be affected by variations in the relative stiffness of rims and arms.

Tests of Rotating Pieces.

The most fascinating and the most spectacular series of experiments have been those in which rotating pieces have been tested to destruction by high speed. As these tests have been carried on for four years, and upward of 40 wheels of various sizes and types have been ruptured it will be impossible at this time to give even a resume.

In carrying on these experiments the wheels to be fractured were guarded by heavy oak plants 12 inches square, and as the fragments frequently split this timber the guards were reinforced with boiler plate. Wheels, models or fly wheels without flanges were operated at a speed up to 400 feet per second, while those made in sections reached the speed of only 150 feet. Placing the joint close to the spoke did not appreciably strengthen the wheel, although steel tie rods between the joints and the hubs increased the strength to some extent. English wheels, built on the bicycle wheel pattern, were the strongest wheels experimented with, giving a speed of 4,000 revolutions per minute. The large number of spokes permitted of no bending of the rim. All of the wheels experimented with were 24 inches in diameter.

A slide was exhibited showing the steel guard plate over a pulley 4 feet in diameter on which the breaking strength was to be ascertained. The outer guard was made of 11-4 inch boiler plate, with 1-2 inch plates on the sides, and protected on the interior with oak timbers. The bursting mechanism was located inside of the shop. A balance weight weighing 3 1-2 lbs. was located inside of the rim, and the wheel burst at 1,200 revolutions per minute. It should have withstood a strain of 2,000 revolutions, and from this experiment the conclusions were reached that no high speed pulley should have a balance weight. An ordinary split pulley which was broken, having a balance weight inside of the rim of 3 1-2 lbs., and whose flange weighed 7 lbs., burst at a speed of 600 revolutions per minute. Views of a broken cast steel fly wheel which reached the speed of 1,700 revolutions per minute were also shown. In the bursting of this wheel some sections were hurled a distance of more than 100 feet. From these tests we reach the following conclusions:

1. Any weight on the rim between the arms of a rapidly rotating wheel, whether it be a flange, a balance weight or otherwise, is a source of weakness and danger.

2. When the weight is accompanied by a joint or any breaking of the metal at such a point the wheel is entirely unsafe at even ordinary belt speeds.

3. Solid rims of cast iron as ordinarily designed are almost entirely free from bending stresses and will not burst at speed much less than 400 feet per second.

In closing, he added that tests on cast iron discs have just been commenced, and so far the difficulties have been found greater than in any other series of experiments. The bursting speed of a disc is from one and a half to two times that of a ring, and this high speed, coupled with the severe shock of bursting, has affected the steam turbine used in making the experiments. So far three 18-inch discs have been burst at a speed of about 7,500 revolutions per minute. This corresponds to a rim speed of about 600 feet per second and to a stress near the centre of about 12,000 lbs. per square inch.

Uses of Electricity in a Modern Factory

By Paul Lincoln.

THE modern factory is usually, perhaps naturally, considered as one of the products of modern civilization and progress. It would be more true to say that modern civilization is a product of the modern factory; analysis will show that this is true. Modern civilization is pre-eminent in the material needs which mankind possesses in these modern times. In former generations every man was his own house builder, his own weaver and spinner, his own brick mason, his own coach builder and harnessmaker, and in fact practically all of the functions which are now carried on by manufacture were then carried on by the individual, each man's manufacture to support his own uses. Since the product of this miniature factory was small the appliances were exceedingly crude and consequently the time required to produce the given amount of material was excessive. Modern arrangements have superseded these. Now one man or one group of men devote their entire time, attention and energies, for instance, to the manufacture of a certain variety of cloth. All the appliances that ingenuity can devise have been provided to enable this group of men to produce the maximum quantity and the best quality of this particular variety of cloth with a minimum expenditure of energy. What is the result? Where one man in former generations could produce only perhaps a few yards of cloth per day, with modern methods the same amount of human labor can produce thousands. Another man instead of weaving cloth spins yarn; another makes wagons and coaches; another harness; and so it goes, each man devotes himself to one specific thing, with the result that the efficiency is increased almost incredibly. By efficiency I mean the net result which can be produced by a certain amount of human labor. Labor is really the only available product that mankind has; no material is of any value unless labor has been performed upon it. Modern civilization is because the efficiency of this element of labor has been increased to a point almost infinitely beyond that which existed in former times; in other words, by modern methods a given amount of labor produces infinitely larger results than in former times. A weaver, therefore, is enabled to expend his labor and energy in the produce of thousands of others who are working on their particular specialty and thus he is enabled to have a total which is almost incredibly beyond the total which our forefathers could possess because the total labor of the present day working at so much higher an efficiency is enabled to produce such vastly increased results over the same labor in former times. I think, therefore, that I can say without fear of contradiction that modern civilization is the result rather than the cause of the modern factory.

Whatever, therefore, increases the efficiency of the modern factory must necessarily make for progress. There is, I believe, no single element that has entered into the increased efficiency of modern methods so much as the use of electricity. Perhaps I should exclude from this generalization the use of the steam engine in all its ramifications. The steam engine is a producer of power

whereas electricity is simply a transmitted power.

There are three classes of men who are responsible for the progress of human knowledge and for the advance of mankind in general. In first of these classes we have the genius who lays down the fundamental laws of science. This class includes, for instance, such men as Sir Isaac Newton, who first enunciated the law of universal gravitation; such men. as Gallileo, Keppler, Copernicus, who laid down the laws governing the heavenly bodies; such men as Carnot, Watt and Rankin, who enunciated the laws of modern thermodynamics. The geniuses in the electrical field come to mind easily because with great wisdom we have named the electrical units from them: Ohms, Ampere, Volta, Galvani, Faraday, Maxwell, Weber, Oersted; all of these men contributed their labors to the electrical science and contributed with such success that their names have been perpetuated by calling after them the units which the electrical engineer has to deal with. These men, too, have labored in the interests of pure science without the hope or expectation for material reward for their labors in this direction.

In the second class of men who are responsible for modern progress are those who, starting with the fundamental laws, have applied them by invention to practical uses. The man who I would name as the first of this class is the one whose name is attached to the concern which I have the honor to represent this evening—Mr. George Westinghouse. His contributions to modern progress have been colossal; they are too well known to enumerate. The number of men in this class is exceedingly large; it embraces such men as Edison, Bell, Howe. Here in Niagara Falls there are some men of world-wide fame who may be included in this class—Hall, the inventor of the process for the production of aluminum, and Atchison, whose work in electric furnaces has placed a new agent in the hands of the world.

The third class that I consider responsible for modern progress is the men who advance the capital necessary to carry on manufacturing activities of modern times. Here again as foremost of his class I would name the same man as before, Mr. George Westinghouse. Westinghouse not only is a creator of ideas, he is as well an investor in ideas and his investments in this class of securities have paid him well. It is this class that probably has been best paid in the material things of the world for their participation in modern progress. A number of instances of such men come to mind readily; Carnegie, who invested in ideas for making steel and has become many times a millionaire; Cyrus W. Field, who invested in the idea of the trans-Atlantic cable; financiers who have invested their capital here in Niagara Falls in the idea of electric power transmission. These are only a few of the examples of this third class who are responsible for the advance of civilization by having sufficient faith to put their money into modern ideas.

All of these classes of men have been particularly active in the field of electricity and instances come to our minds in this field with particular ease because the development in this field has been so rapid. It is only a little over a hundred years since the electric fluid has had a name. It has been considerably less than a hundred years since the first intelligence was transmitted by electricity. It is only within the last twenty-five years, however, that rapid progress has really begun in this line. It is only within that time that the art of lighting by electricity and the art of generating it for mechanical power has been perfected.

Electricity has become an agent for the advancement of civilization in two ways; first, it has produced methods of doing things which were done by other means formerly, but doing them in a much quicker and more efficient manner. For instance, formerly the power of a steam engine was transmitted to the lathe by means of belts and shafting, which means were both expensive and inefficient, cumbersome and dangerous. Go into the modern factory and you see no belts or shafting with its continual wear and nerve-racking hum. In its place you will see a few innocent wires which carry the electricity from the generating point, situated to suit convenience, directly to the piece of apparatus that it is wished to operate. As for lighting, it has done away with the expensive and dangerous oil and gas and has substituted a brilliant, easily controlled, inexpensive source of light. Many other instances could be named in which electricity, although it has accomplished nothing new, has enabled us to accomplish those things with much greater efficiency.

Second, electricity produces things which without it would be absolutely impossible. The whole art of electroplating, for instance, depends absolutely upon its use. The art of dissociation of compounds by the electric current and their recombing into other compounds is due to its use. For instance, the process of aluminum production which is carried on so extensively here in this city. The process of decomposition of salt and recombing its elements into other compounds is due absolutely to its use. The electric furnace is but another tool which, used by such men as Atchison and others who are familiar to you, has become an agent to produce results absolutely unattainable by other means and will become no man knows how useful an agent.

LARGE INCREASE IN IRON PRODUCTION.

THE production of all kinds of steel ingots and castings in Canada in 1905 exceeded the record of 1902 by 221,412 tons. As compared with 1904, the increase amounted to 254,665 tons, or over 171 per cent. Bessemer and open-hearth steel ingots and castings were made in 1904 and 1905, the production of open-hearth steel amounting in the latter year to over 59 per cent. of the total.

The following table gives the production of all kinds of steel ingots and castings in Canada from 1894 to 1905, in gross tons:

Years.	Gross tons.
1894	25,685
1895	17,000
1896	16,000
1897	18,000
1898	21,540
1899	22,000
1900	23,577
1901	26,084
1902	182,037
1903	181,514
1904	148,784
1905	403,449

The production of all kinds of finished rolled iron and steel in Canada in 1905 was also much greater than in any previous year, and amounted to 385,826 tons, as compared with 180,038 tons in 1904, the year of next largest production, an increase of 205,788 tons.

The following table gives the production of all kinds of iron and steel rolled into finished forms in Canada from 1895 to 1905, in gross tons:

Years.	Gross tons.
1895	66,402
1896	75,043
1897	77,021
1898	90,303
1899	110,624
1900	100,690
1901	112,007
1902	161,485
1903	129,516
1904	180,038
1905	385,826

The production of Bessemer and open-hearth steel rails in 1905 amounted to 178,885 gross tons, against 36,216 tons in 1904; structural shapes, 885 tons, against 447 tons in 1904.

The total quantity of all kinds of iron and steel rolled into finished forms in Canada in 1905, including forging blooms and forging billets, amounted to 385,826 tons, against 180,038 tons in 1904. Of the 385,826 tons of finished iron and steel reported for 1905, about 318,495 tons were rolled from steel and 67,421 tons from iron, as compared with 126,850 tons rolled from steel and 52,188 tons from iron in 1904.

Practical Mechanics

BY W. H. RAEBURN

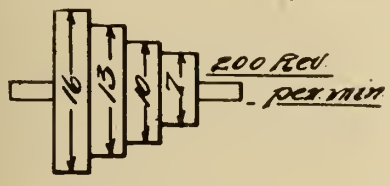
Article VI. A descriptive discussion of an important subject, simply and clearly stated. Every article of this series should be read and studied by all readers of Canadian Machinery. They are practical and helpful.

GEARING.

WE have discussed a few simple problems in gearing, and the number could easily be increased with profit to the student, although the same principles run through all cases, and when these principles are understood there is little difficulty in applying them.

Lathe Pulleys and Gears.

A very interesting study in speeds obtained by a combination of pulleys and



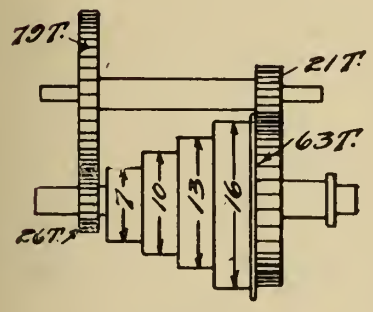


Fig. 1

gears is found in a cone-driven lathe, and we shall now briefly consider such a drive—that for an ordinary 24 in. lathe. In Fig. 1 we have represented in outline the driving parts—gears and cone pulleys—the cone pulley on the countershaft being of the same dimensions as that on the lathe spindle.

We shall start with the assumption that the countershaft makes 200 rev. per minute, and find the four different speeds at which the spindle cone pulley can be run. The fastest is $200 \times \frac{16}{7} = 457.14$; the next $200 \times \frac{13}{10} = 260$; next $200 \times \frac{10}{13} = 153.84$, and the slowest $200 \times \frac{7}{16} = 87.5$. When the back gears are thrown out and the cone lock used to lock the cone to the spindle gear, the above speeds represent the speeds of the spindle, but when the back gears are in and the cone lock disengaged the spindle speeds are much slower than those of the cone, the reduction depending on the back gear ratio.

The term back gear ratio in another form means the number of turns the cone has to make to cause the spindle to revolve once. This it will be seen depends on the proportions existing between the number of teeth in the gears and pinions forming the drive.

If the pinion which is secured to the cone had only a third of the number of teeth that the gear with which it engages has, that gear and the pinion attached to the quill on which it is secured would revolve 1-3 rev. to one of the cone; then if the spindle gear had three times as many teeth as its driving pinion the spindle would revolve 1-3 rev. to one of the back gear quill, so that while the cone made one rev. the spindle would make $\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$ rev., or the cone would have to make 9

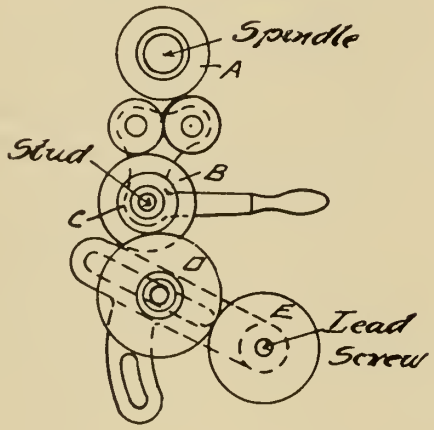


Fig. 2

rev. to revolve this spindle once, and we would say the back gear ratio was 9. We have taken this supposed case for ease of illustration, but it is not always possible to have the back gear ratio represented by a whole number, since the two pairs of gears must run at the same centre distances, and the pitch of the teeth is nearly always greater in the spindle gear and its pinion than in the others. Later on, when we take up the subject of gear teeth, we shall illustrate this part more clearly. In the case before us the back gear ratio is $\frac{79}{26} \times \frac{63}{21} = 9.115$. Now if we divide each of the cone speeds found above by 9.115, we shall have the spindle speeds obtainable with back gears in $\frac{457.14}{9.115} = 50.1$; $\frac{260}{9.115} = 28.52$; $\frac{153.84}{9.115} = 16.87$, and $\frac{87.5}{9.115} = 9.59$.

The spindle speeds then are: 457.14 — 260—153.84—87.5—50.1—28.52 — 16.87—9.59.

Now these speeds do not increase by equal amounts, but are arranged approximately in what is termed geometrical progression, that is to say, each speed other than the slowest is equal to one next below it multiplied by a constant quantity, at least nearly enough constant to serve practical purposes.

A very desirable feature in deciding on back gear ratio is to have the change of speed obtained by throwing in the back gears and shifting the belt from the largest to the smallest step of the cone correspond to a change obtained by shifting the belt from one step to the next. This preserves the progression unbroken. In the case before us the change is made between the speeds of 87.5 and 50.1, and there is practically the same relation between these two speeds as between any other two adjacent speeds on the list. The relation is expressed by the quantity obtained by dividing the greater by the

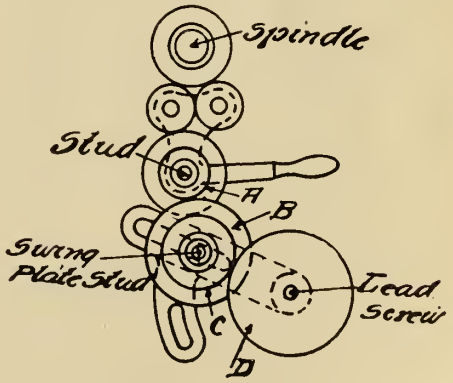


Fig 3

less, and here that is approximately 1.75, which is termed the ratio of progression. Perhaps the man at the lathe is more interested in the arrangement of gearing for cutting screws than in the driving gears, and although the tendency to-day is towards automatic, or at least semi-automatic, devices, yet the machinist should not drop his inter-

est in the how and why of this matter of screw-cutting gearing.

Many are thoroughly familiar with the subject, but this article is not for them. We hope to reach a few who shrink from a problem in this line because of frequent use of algebraic expressions. While these are great aids, it is not impossible to work without them.

Simple Gearing.

The numerous quick gear change devices that are in use to-day alter the appearance of the old-time lathe, but the same elements as ever are there, although in different form, so that we are quite safe in taking the older and perhaps best known form of gearing arrangement as an illustration. In Fig. 2 is shown a common arrangement of change gearing of a lathe, this being what is known as simple gearing. The tumbler gears for reversing are familiar to all having had anything to do with lathes. From what we learned from the last article, gear (A) on spindle and (B) on stud will run in unison with each other if they are made with the same number of teeth. Gear (C) on the stud and (E) on the lead screw can be changed to suit requirements, and it is with the finding of the proper number of teeth in these two gears that we are now concerned.

It is clear that if (C) and (E) are equal, (D) being an intermediate or idler does not enter into the problem, the gear on the stud, therefore the gear on the spindle and the spindle itself will make the same number of revolutions in a given time as the gear on the lead screw and therefore the lead screw itself.

Thus a threading tool would cut on a shaft a thread of exactly the same pitch as that of the lead screw. Let us change gear (C), making it one with only half the number of teeth in (E). The spindle will then have to make twice as many revolutions as the lead screw in a given time, and the pitch of the screw cut will be one-half that of the lead screw.

Any other ratio of gears would show similar results, so that we have the simple rule that the number of threads per inch cut is in the same proportion to the number of threads per inch in the lead screw as the number of teeth in the lead screw gear is to the number of teeth in the stud gear. Take a practical example: Let it be required to cut 7 threads per inch, the lead screw having 4 threads per inch. The number of teeth in the gear on the stud must be 4-7 of the number of teeth in the gear on the screw, and any two numbers bearing this relation to each other will be suitable, but, of course, our supply of gears is limited, so we select what we think will be a suitable gear for the stud, say 20 teeth. 20 is 5 times 4, so that if we take 5 times 7 = 35 we have 20 and 35 as the two gears required. A suitable intermediate (D) must be used to reach from one to the other. To put one rule in another form, we have this: Write a fraction whose numerator is the number of threads per inch in the lead screw and denominator the number of threads to be cut, then multiply these two figures by any one figure until the two numbers obtained represent gears that can be found in the set and used in conjunction with a suitable idler. The above rule will always work on simple geared lathes.

One more example: Lead screw 5 threads per inch; work 11½ threads per inch (pipe thread).

$\frac{5}{11.5}$ multiply each by 4 and we have $\frac{20}{46}$ the gears required, but we may not have a 46-tooth gear. Doubling both numbers, we have 40 and 92, but the latter may not be in the set, so we try multiplying $\frac{5}{11.5}$ by 10 and we have $\frac{50}{115}$ representing two gears we can probably obtain.

Compound Gearing.

Considering now the compound geared lathe, in it instead of a single idle gear being used on the swing plate, there are two gears—keyed to each other—the one engaging with the gear on the stud and the other with the gear on the lead screw, as shown in Fig. 3.

We have thus two points at which to vary the speed ratio, and it is possible to accomplish a desired result by several different combinations. Let it be required to cut a screw with 2½ threads per inch in a compound geared lathe and the lead screw having 4 threads per inch. According to the rule for simple gearing $\frac{4}{2.5}$ represents the ratios between the gears, and 40 and 25 tooth gears could be used in simple gear. This is a case of speeding up the lead screw, the ratio of increase of speed being 40 to 25. Although the increase is small we shall try to divide it between the two pairs of gears in the train. Choosing 50 and 40 for the first pair of gears, (A) and (B) $\frac{50}{40}$ will be the ratio of increase obtained by means of these. But we must have $\frac{4}{2.5}$ or $\frac{40}{25}$ as a total ratio of increase to enable us to cut the desired thread, so that we must find another fraction which, multiplied by the former will produce $\frac{40}{25}$. Divide the latter by the former to get this fraction $\frac{40}{25} \div \frac{50}{40} = \frac{40}{25} \times \frac{40}{50} = \frac{32}{25}$. Thus gears (B) and (D) should have 32 and 25 teeth, respectively, but 64 and 50 teeth would probably work in better. Proving our work we have $\frac{50}{40} \times \frac{64}{50} = \frac{8}{5} = \frac{4}{2.5}$, the fraction we commenced with.

We shall conclude with another example: Lead screw 2 per inch, thread to be cut 14 per in. Here we have the total speed ratio $\frac{2}{14}$ to be divided into two reductions $\frac{2}{14} = \frac{20}{140} = \frac{5 \times 4}{14 \times 10}$, so that any two pairs of gears whose numbers of teeth give the fractions $\frac{5}{14}$ and $\frac{4}{10}$ will suit. Multiplying all numbers in these fractions by 5 we have 25 and 70 for (A) and (B), and 20 and 50 for (C) and (D).

LARGE ORDERS.

THE Canadian Westinghouse Co. have secured several important contracts recently, among which the more interesting are as follows: One for supplying the Provincial Light, Heat & Power Company with apparatus to be used in the development of another large water power plant near Montreal. The initial installation will consist of three 3,750 k.w., revolving field, alternating current, water wheel driven generators of 4,000 volts, three phase, 7,200 alternations; also twelve 2,500 k.w., 4,400 volts, oil insulated, water cooled transformers. This new power station will be used for supplying additional power to the Montreal Light, Heat & Power Company at Montreal. The step-up transformers will be wound for 4,000 to 44,000 volts, and the lowering from sion line is about 40 miles in length. Another is for the Northern Electric & Mfg. Company, of Montreal, for a 300 k.w., Westinghouse-Parsons turbo generator unit, to be installed alongside of one of the same capacity now in service. The generator is a 220 volt, three phase, 7,200 alternation machine, operating at 3,600 r.p.m., and will be of the latest enclosed type, while the turbine will operate at 150 pounds steam pressdre with 100 degrees superheat. Their present turbine is operating part of the year condensing and through the Winter non-condensing, the exhaust steam being used during the Winter for heating purposes. It was the splendid operation of this steam turbine generating unit which led the company to order the one about to be installed.

Mechanical Reviews

OPINIONS AND STUDIES WORTH NOTING

SOME PUMP AND ENGINE IMPROVEMENTS.

FIGURE 1 represents a combined air and circulating pump on which we made an improvement in the cross-head. As originally designed, the steam and water pistons were connected by a continuous rod and the crosshead was slipped over this rod and held in place by a set-screw. This crosshead would slip on the rod sometimes, but if you wanted to take it off, a 10-pound sledge hammer would not persuade it to slip. The half of the rod between the cross-head and the water piston had to be renewed every once in a while, as the circulating end of the pump gets more or less sand. The cylinder heads (D) and (E) are cast solid with the frame of the pump, so they cannot be removed, and in order to renew the crosshead or the

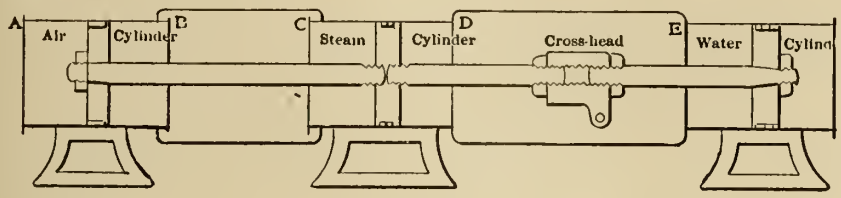


Fig. I.

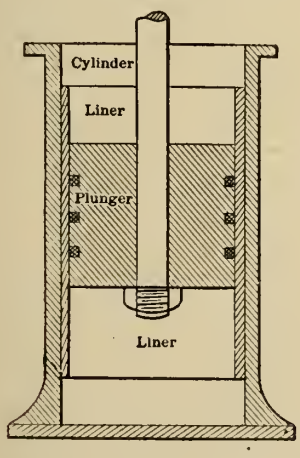


Fig. II.

rod it was necessary to take off the heads (A) and (B), then remove the water piston and slide the air and steam pistons out of their cylinders, loosen the lock-nut on the water piston rod and then unscrew the rod out of the steam piston. By substituting the cross-head here shown for the old one and cutting the rod in two all this trouble was eliminated. The rods being screwed in and held by lock-nuts, there is no chance for the crosshead to slip, and each rod is independent of its neighbor. There is quite a saving of brass also in a year's run, as the steam rod can be made of steel. Care should be taken that the nuts do not strike the glands, which will occur if the crosshead is made too long.

Fig. 2 shows an improvement that was made to a vertical duplex pump. The sketch shows a cross-section of the cylinder of the water end, its brass liner and brass plunger. In this type of pump the builders intend the solid brass plunger to run unpacked in the brass liner. That is all right as long as there is no wear, but I have yet to see one that does not wear. Of course they can be renewed, but brass is no cheaper in this part of the country than elsewhere; so we hit upon the following scheme to cut this expense down:

Grooves similar to the packing-ring grooves of a piston are turned in the plunger 5-8 inch wide and a little less than 5-8 inch deep, depending on how much the plunger is worn. We insert 5-8 inch hydraulic packing in these grooves, put the plunger in the cylinder and connect the rods together, and we know the pump will work at its rated capacity for three months.

If the reader is thinking of fixing a pump up like this, however, he must not get too industrious and try to cover the whole length of the plunger with grooves. We tried that and at the first stroke the pump made the lower end of the plunger went below the end of the liner, as the builders intended it should, and the end rings of packing came about half way out, and when the plunger started up it went about an inch and stopped. It took three jack-screws to get the plunger out and after that we put packing around the central part of the plunger only.

Fig. 3 shows how a broken bonnet was repaired. The collar on the end of the dash-pot plunger had a habit of working off, and this of course makes the dash-pot rod too long. It is possible to braze some small bonnets, but on the larger ones it does not seem to work. These bonnets usually break at the point marked (X), and generally do no other damage, although once in a while a stem will be bent. The bonnet was bored out and the sleeve was made and pressed in. The end of the sleeve was threaded and the round nut (N) was screwed on by means of a punch, and the holes drilled in the circumference of the nut. A collar (C) was shrunk on the end of bonnet

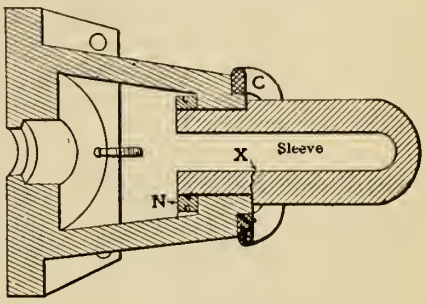


Fig. III.

to keep it from splitting when the sleeve was pressed in.

Fig. 4 shows how we ended our dash-pot troubles. The collar (K) would work off the plunger and make dash-pot rod too long. The screw (B) was supposed to hold a small threaded section tight enough to keep the collar from turning, but it did not do so. A hole was drilled through the collar at (A) and about 3-4 inch into the plunger at (D).

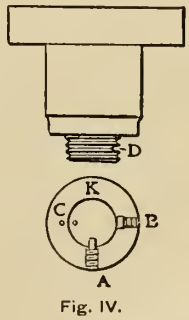


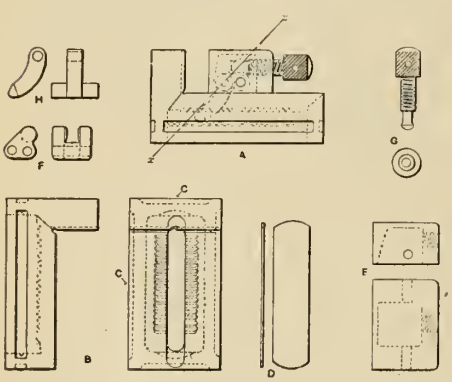
Fig. IV.

The holes in the collar are tapped out, the larger ones for 5-8 inch and the smaller for 1-2 inch screws. We used steel screws with the ends turned off to enter the hole (D). The other end is slotted for a screw-driver. The bottom of the plunger and the collar are marked with a centre punch, as at (C), so as to show when the holes are in alignment.

The set-screw (A) cannot get out because the collar is surrounded by the wall of the dash-pot. It is also certain that the collar will not turn with 3-4 inch of screw in the hole (D). This collar has only one position on the plunger, so that if one leather is not as thick as the one we had on when the hole (D) was drilled, we make up the difference with a piece of thick paper.—"Practical," in Power.

TOOLMAKER'S VISE.

IN the shop where I was employed some months ago there were about 75 toolmakers and every one seemed to have better ideas than the other, paradoxical as it may seem. This simply means that they had different views. One day one of them showed the other a design of toolmaker's vise. It was well demonstrated and every one seemed to like it very much, but when he made it they one and all had something to say against it. The principal objection seemed to be that the hook screw extended



Tool Maker's Vice.

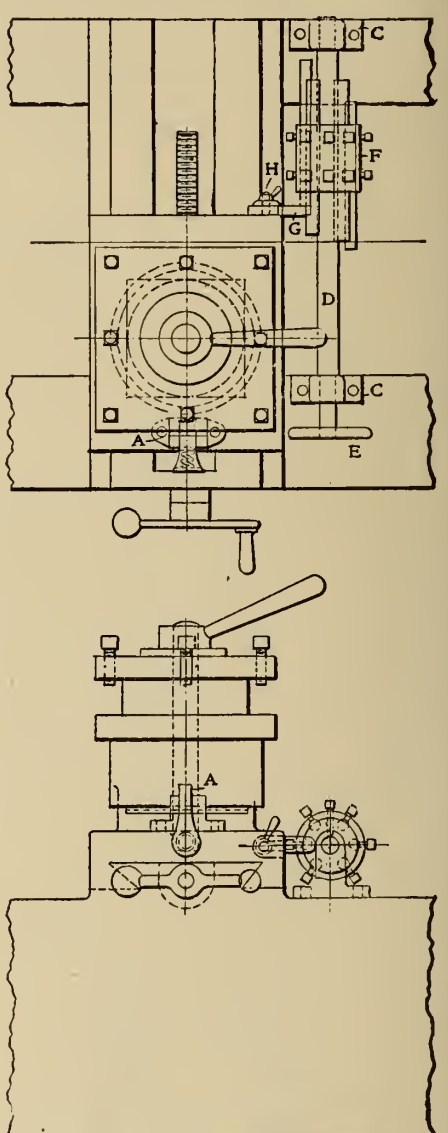
above the top of the rear jaw so that when using it for grinding or planing lengthwise the nut was in the way. Another vise was immediately made by another toolmaker, using the same design but with the hook screw shortened and the nut countersunk into the rear jaw at an angle of about 45 degrees. With this a cup-wrench was required to tighten the nut. At the same time still another vise was made of an entirely different design of tightener in the rear jaw which when compared with the other proved to hold the work much more tightly when screwed up with about the same power. It is a common saying that it takes a good man to design a creditable job, but any fool can criticize, and I must confess that I am one who is guilty in that respect.

But having found this tool very simple and convenient in its construction, I thought it worth while to illustrate it in Machinery, for we all know how difficult it is at times to handle small pieces of work; it is often necessary to solder them into a plate in order to do accurate work. The vise is made square and parallel on all sides and is 2 13-16 inches long, 1 1-2 inch wide and 1 1-2 inch high. The sketch at (A) shows the vise assembled, and surrounding it are the parts. (B) is the body made of tool steel and pack-hardened, ground and lapped square all over; it is milled out inside and 19 ratchet teeth are cut with an end mill at an angle of 30 degrees. In the centre is a slot with round ends in which the hook (H) can move freely. A V-groove of 45 degrees angle is cut in the face of the stationary jaw square with the base so as to hold small round pieces vertical. On each end inside is cut a narrow slot 1-16 inch deep to fit the thin spring plate (D), which is inserted to prevent the hook dropping down. The movable jaw (E) is also made of tool steel and pack-hardened, ground and lapped over. A recess is cut in the under side of the sliding jaw with a round cornered end-mill, and a pin-hole is drilled transversely through the jaw for the pin to hold lever (F); at the back a 5-16 inch hole is drilled and tapped for screw (G). The hook (H) is made of tool steel hardened in oil and drawn to a straw color. It is made T-shaped, the body being slightly less than 1-4 inch thick so as to work freely in the slot in the base, and a pin-hole is drilled at the upper end through which a pin is fitted to join it to the lever (F). Lever (F) is made of tool steel pack-hardened while screw (G) is spring tempered; the screw is made 20 pitch left-hand so that when turned to the right it will tighten the jaw. The line x—x through the point of the hook and the centres of the lever (F) when in line should make an angle of about 45 degrees so that when the screw is tightened the jaw will be drawn down against the base with about the same resultant pressure as is applied against the stationary jaw.—O. Westberg, in Machinery, N.Y.

A LATHE TRANSFORMED INTO A TURRET MACHINE.

THE only turret lathe in the shop was so crowded with work that two ordinary lathes had to be run on the same job. The production of the lathes was disappointing, and served to prove the usefulness of the special machine. Buying a new turret lathe was out of the question, for the rush was only temporary, and it was thought of transforming one of the lathes into a turret machine, which was done at a light expense, as shown in the sketches.

The compound slide was removed and a fitting turned for the turret, whose simple construction is clearly shown in the sketch, which also shows at (A) a combination of a bracket, latch and spring to lock the turret at four different positions. The turret stop consists of two brackets (C C), bolted on the carriage; a shaft (D), hand-wheel (E) and muff (F) that has six rods of convenient lengths. On the cross-slide is a strap (G) with a long slot. Bolt (H) is square at the base to fit the slot of the strap, and has a nut with a handle. To



A Lathe Transformed into a Turret Machine.

turn muff (F) the strap is brought back to be pushed forward and fastened when the muff is in the right position. In this way the production of the machine was doubled.—J. M. Menegus, in American Machinist.

The Kilkeel Co., Limited, Toronto; capital, $20,000; purpose, to build and operate steam vessels. Directors are: A. W. Mackenzie, D. B. Hanna, L. W. Mitchell, G. G. Ruel, G. F. Macdonnell, all of Toronto.

Tricks of the Trade.

Everybody is invited to contribute to this page. Send in your ideas, odd jobs you are doing, and anything of interest to fellow-workmen. Remuneration will be made for such contributions. [Ed.]

CHANGE OF SPEED.

THE accompanying figure will give a suggestion of a simple speed change device, where small amounts of power are transmitted. (A) and (B) are two cast iron or steel discs keyed to shafts, and (C) is a disc of rawhide, or similar material, which can be moved up and down between the limits of the upper edge of disc (A) and the lower edge of disc (B). Disc (A) in revolving transmits motion to (C) and (C) transmits it to (B), there being, of course, some device for producing a pressure between (A) and (B) of sufficient magnitude so that (C) will transmit the motion. This might be done with a spring attached so as to pull (A) against (C), (B) being fixed, the pull of the spring required depending upon the amount of power transmitted. The relative speed of (A) and (B) will depend upon the position of (C); the higher up (C) is the greater will be the speed of (B) with regard to (A), and the lower (C) is, the less will be the speed of (B) with regard to (A).

The strength of the spring required may be found in the following manner:

From the horsepower transmitted and the speed of the shaft, the torque can be found from this formula:

$$T = \frac{33000}{2\pi} \times \frac{H.P.}{N}, \text{ where}$$

T=torque in ft. pds.

H.P.=horse power transmitted, and N=revolutions of driving shaft per min.

Thus from the speed of the driving disc and from the amount of power transmitted, the torque on the driving shaft can be found. Now, the pressure between the driving surfaces must be great enough so that the frictional force, when the disc (C) is in any position, will produce a torque that will transmit the required power from the driving to the driven shaft at the required speed. Now torque is the force multiplied by the distance from the centre of rotation. For a constant torque this force will be greatest when its point of application is nearest the centre of rotation. That is, this force in the driving disc will be greatest when the speed of the driven shaft is least, since then will disc (C) be nearest the centre of disc (A), the driving disc. The distance of the middle line of disc (C) from the centre of disc (A), when (B) is revolving at the lowest required speed, can be found experimentally easier than by calculation, although it can be found in either way. Then

$$P = \frac{T}{r} \text{ where}$$

P=force in pds.

T=torque in ft. pds.

and r=distance of centre line of C from centre of A in ft.

Then $T = Pr = u\,Q\,r$, where

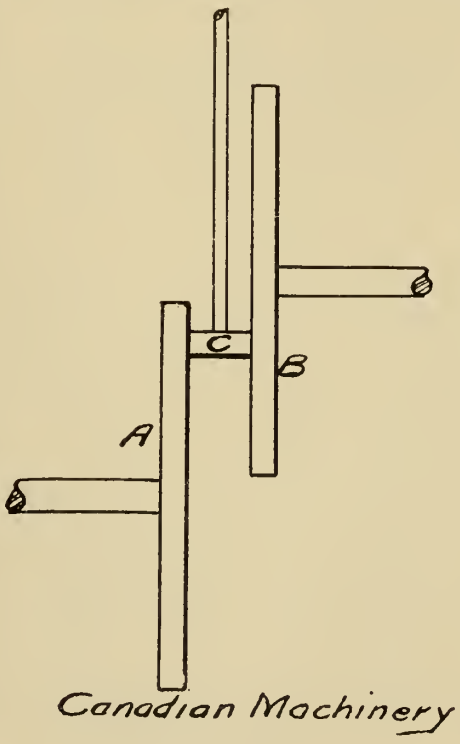
Q=pressure in pds. required between the driveway surfaces, and

u=coefficient of friction.

Then $Q = \frac{T}{u\,r}$

and Q represents the strength of pull of spring in pds. required.

It may be noted that $\pi = 3.14$, and the co-efficient of friction from rawhide on iron or steel is 0.56 if the metals are kept dry.



Speed Change Device.

Hamilton. W. K. Mc.

THEORY AND PRACTICE.

MANY and varied are the opinions held concerning the relative importance of theory and practice. For the most part college men recognize the value of stern practice, if not during their college course, after they get out into actual work. But the purely practical man—the graduate of the workshop only—is oftentimes slow to acknowledge the value of theory. I have heard discussions on this topic which were simply ludicrous because of the one-sided ideas set forth and the absurdly unjust assertions made. In my way of thinking, it is unnatural to regard theory as a thing apart from practice. To give the best results theory and practice must go hand in hand, since upon theory depends practice and upon practice, theory. Without theory practice would not be what it is to-day, and but for practice theory would indeed be narrow and limited. Wherein the design and construction of a machine hinges on theory must be plain to all, and its dependence upon a minute knowledge of practice is only too apparent to any concerned in this work. But there are some men, with little or no theoretical training, who get on wonderfully well. I know of a man, a veritable genius around machinery, with no theoretical knowledge and in fact only a common school education, who has originated not a few machines that are in successful operation in Canadian shops. And how does he do it? It would seem as if it were by instinct; and if that is so the instinct must have come to him as a result of his absorbing interest in machinery from the time he carried tools as an apprentice until now he is an old man. No such thing as strength calculations for him! He just thinks what would be a good size and then it is made. But he is no doubt working in the dark. It cannot be otherwise. Instinct is good, but instinct is very far from being infallible. In my wanderings here and there it has been impressed upon me that the successful man is the man who has neglected neither theory nor practice. He has not necessarily gotten his theory at a college—there are divers ways of getting a theoretical training—but he has obtained it in some way, the more difficult the way oftentimes the more use is made of it eventually. But there are exceptions.

Other readers of Canadian Machinery may have different views along this line and I would be pleased to see them expressed in these columns.

Toronto. J. C. A.

ENGINE EFFICIENCIES.

WHEN engine performances are under discussion, and "experts" are in the act of twisting the "plain mechanics" all up with percentages of efficiency, and pounds of steam per indicated horsepower, here is a little sum that will prove a hot shot to the man who quotes figures without thinking for himself:

By Joule's experiments we know that one B.T.U. (British thermal unit) represents 772 foot pounds of work, or vice versa, 772 foot pounds of work will raise 1 pound of water 1 degree F. By averaging repeated measurements of the heating power of fuels we know that ordinary steam coal contains about 12,000 B.T.U.; that very good steam coal contains about 15,000 B.T.U., and that petroleum oil contains about 20,000 B.T.U. Then multiplying the heat units by the equivalent in foot pounds (772), and dividing the product by the number of foot pounds in a horsepower per min. (33,000), we will get the potential horsepower of a pound of fuel, as follows:

Good steam coal of 12,000 B.T.U. = potential of 280.72 H.P. per min.=4.68 H.P. per hour per lb.

Best steam coal of 15,000 B.T.U. = potential of 350.99 H.P. per min.=5.85 H.P. per hour per lb.

Oil fuel of 20,000 B.T.U. = potential of 467.9 H.P. per min. = 7.79 H.P. per hour per lb.

The best performance to date is very nearly 1 pound of best coal per I.H.P. and a little better than 1 pound of oil fuel per B.H.P., or thereabout.

That would show the energy turned into useful work to be but a fraction of 1 per cent. of the energy known to exist in fuel. This is so very far from the percentages usually quoted—about 28 per cent. for best steam practice—that a word of explanation will not be out of place to even a few professional readers.

Steam engines of good design, well made and well looked after, will have a mechanical efficiency of as high as 92 or 93 per cent.: viz., of 100 per cent. of power delivered to the piston-head 92 or 93 per cent. can be got off the crank shaft; the difference goes in friction, heating of oil and bearings, motion of valve rods, governor, etc., and the increment of wear and tear.

Of the heat delivered to the engine in the steam, a certain portion does useful work during expansion, a portion disappears unaccounted for, and a portion is rejected, in the exhaust, in radiation, clearance, valve leakage, and other losses. Now, in accordance with the pressure and temperature drop during a working stroke, there is a certain proportion of the heat considered available, and there is a certain portion of the so-called entropy diagram that is considered to be unavailable, and this theory gives rise to the measure of a theoretically ideal engine working on the Carnot cycle, the Rankin, or Clausius cycle, against which the actual engine, under nearly similar circumstances, is measured, and that is where they get the commonly quoted 28 per cent. or 30 per cent.—not, be it noted, of the actual energy available in coal or oil fuel, but a portion of the heat available in steam, a standard set up for comparison only.

But before the steam got to the working point there were good big losses in the piping, in the boiler, in the furnaces and up the chimney. We can see many ways of escape. When, however, we note the few hundred odd horsepower slipping through the petrol engine for the insignificant one we capture and partly utilize, the engineer cannot help feeling humbled by the contemplation, and naturally turns for refuge to a Carnot cycle, or some other device, to improve his position before the consumer. That is how it stands.

Montreal. C. J. Stuart.

Practical Questions and Answers

Tapers and Taper-Turning.

Ques.—Will you explain clearly how tapers are designated—there is often confusion and difference of opinion concerning this—and show how tapers are turned by offsetting the tailstock, and explain the principle of the taper-turning attachment on lathes?

Ans.—When tapers are given in amount per unit of length, as inches per foot, the difference in the diameter at the two ends is always meant. That is, if a bar 5 feet in length has a taper of 1 inch per foot, the difference between the diameter of the two ends is 5 inches. But in designating tapers by the angle there does not seem to be a general standard method, and to avoid confusion it should be stated whether the taper angle is between the two sides or between the centre line and one of the sides. The simpler method of denoting tapers, except those that can be turned only by means of a compound rest such as the taper required on a reamer used to ream a valve seat to a certain angle, is by the amount in inches per foot of length. If the taper is given as an angle it cannot be turned in the ordinary lathe between centres or by means of the taper-turning attachment until the taper angle has been converted into inches per foot of length.

The turning of a taper in an ordinary lathe between centres by moving the tailstock over is simple, but a perfectly accurate taper is not obtained, as will be shown. Figure I shows this method of turning a taper. The piece of work to be tapered is placed between centres and the tailstock moved forward across the lathe bed a distance equal to half the amount of the taper in the whole length of the work. Thus if the work is 3 feet long, a taper of 1 inch per foot of length is required, then the total taper will be 3 inches and the tailstock will be moved forward 1½ inches. The tailstock is moved forward half the total taper because the tool moves along a line parallel with the centre line of the lathe, and it is thus obvious that if the tailstock is moved out of line 1½ inches a taper of 1½ inches measured to the centre of the work will be given, which is the same as a 3-inch taper, measuring the difference of diameters, which is what is required.

If the work is of reasonable length and the taper not too great, this is a fairly accurate and quite satisfactory method of cutting tapers. But when the work is short and the taper relatively large the inaccuracies of the method become very apparent, and in cases of this kind the method is not satisfactory. These inaccuracies will be apparent in figure II When the tailstock is moved forward 1½ inches, as in the example quoted, a taper of 3 inches is given to the length of work between centres; but the length between centres is not 3 feet, the length of the work, but is less than that by the distance the live and dead centres project into the work. Thus instead of getting a taper of 3 inches in a length of 3 feet, the taper of 3 inches is in the shorter length. The taper is, therefore, not correct, but when long work and small tapers are being dealt with this practically makes no difference. However, from figure II it can be seen that in short work this would throw the taper out considerably. Thus instead of

there being a taper of the required amount in a length "l," it is in the length "l," the distance between centres. An example will show this plainly. A piece of work 6 inches in length is required to be $2\frac{1}{2}$ inches in diameter at one end and 1 inch in diameter at the other; that is, a taper of 3 inches to the foot is required. The work will be

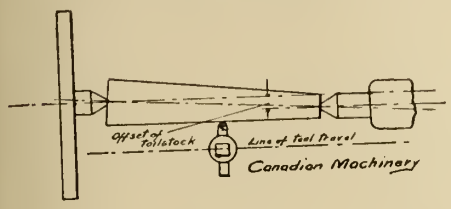


Fig. I.

ent off the required length, i.e., 6 inches, and will be placed between centres, the tailstock being moved forward half the amount of the required taper, i.e., $\frac{3}{4}$-in. Suppose that the centres extend into the work 3-16 inch at each end; then instead of getting a taper of $1\frac{1}{2}$ inches in 6 inches it will be in $5\frac{5}{8}$ inches, giving a taper of 3.2 inches per foot of length. This would mean that in a length of 6 inches there would be a taper of 1.6 inches, and if the small end were tapered to a diameter of 1 inch as required, the large end would be 2.6 inches in diameter instead of 2.5 as required, making the large diameter 1-10 inch too large.

In a case like this the taper can be turned only by moving the tailstock over by degrees and calipering the work until the correct taper is obtained, which is tedious and not always satisfactory.

By referring to figure II, another difficulty in the way of producing an accurate taper when the work is short and the taper large will be apparent; that is the impossibility of properly centreing the work and keeping it steady between centres. The points of the centres instead of being free will bear on the sides of the holes made by the centreing tool,

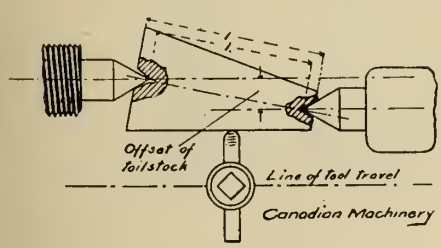


Fig. II.

and thus it cannot be assured that a smooth, even taper will result.

In figure III is shown the principle upon which all taper-turning attachments operate. With this arrangement there is neither of the foregoing difficulties to be met with. The two centres are always in line, and the taper being laid off on the adjustment bar, there is no difficulty with short work. The distance between the adjustment bar supports is fixed, and the amount of taper required for this length being laid off by the adjustment bar, as the carriage moves up the tool follows the slant of the bar producing the correct taper in the work.

Gas Turbine.

Ques.—Will you tell me whether there have been any gas turbines patented or placed upon the market in Canada or the States; and if not, will you give me the chief reasons that the turbine principle has not been taken advantage of with gas as it has with steam?

J. H. P.

Ans.—So far no gas turbine has been placed upon the market either in Canada or the United States, or if there has been, the fact is not widely known. There have, however, been gas turbines patented, and experiments are now being made with them, but in spite of this the prospects for the production of an efficient gas turbine in the near future are not very bright, because the highest authorities on gas and gas engines are not at all optimistic. The three big obstacles in the path of the gas turbine

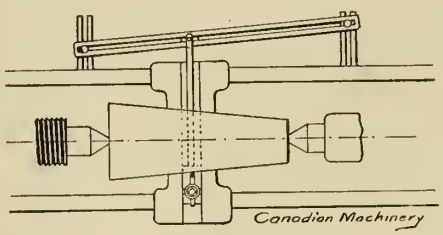


Fig. III.

are: The high temperatures necessary to economy, temperatures so high that no known constructive material can long withstand their action; the high peripheral velocity necessary to the economical use of gas in a turbine, which velocity results in too great a centrifugal force for materials to stand; and the difficulty of compressing the gases to a sufficiently high pressure in a turbine.

It is claimed that these difficulties can be overcome by combining a reciproeating with a rotary movement, the turbine part of the combination being put to the same use as the low pressure cylinder in a double expansion steam engine. The mechanism is as follows: A pair of opposed cylinders have their crank-shafts geared to the shaft of the turbine; these cylinders are operated upon the Otto cycle, the exhaust being forced into the turbine, first mingling with steam from a boiler of the automobile type. The gases in mingling with the steam are lowered in temperature, while keeping almost the same kinetic energy, and since the kinetic energy remains the same and since the mass is increased, the velocity is decreased. The cylinders are water-jacketed, the heated water going to the boiler. From this it would appear that all three difficulties are overcome; but so far no proof has been given that this is commercially feasible.

Weight on Safety Valve.

Ques.—What is the rule to find the weight necessary to put on a safety valve lever when the area of valve, pressure, etc., are known?

Ans.—A rule covering this case is as follows: Multiply the area of the valve by the pressure in pounds per square inch; multiply this product by the distance in inches of the valve from the fulcrum; multiply the weight of the lever, in pounds, by one-half its length; then multiply the weight of valve and stem by this distance from the fulcrum, add these last two products together, subtract their sum from the first product and divide the remainder by the length of the lever; the quotient will be the weight required.

RE-CUTTING STRIPPED NUT AT SEA.

I read the article on above in May issue of Canadian Machinery. It is not an unusual occurrence for square threads to give out at sea. I myself have compressed a larger nut to fit the intermediate stop valve spindle, and that without stopping the engine. The nut was square threaded and same pitch. I have also taken the spindle nut off the injection valve screw and put a 1-inch nut on. This was on account of the condenser doors having to come off, the condenser being leaky. I have also re-screwed a main bearing bolt 3 1-2 inches. On board ship, time is a consideration. It was impossible to remove the bottom nut, therefore we took the top nut ashore and had three grooves slotted in and tap bolts fitted in the cant where the slot was, the slot being fitted with steel dies, having a thread on one side, and with a new nut on board we sailed away. I may mention that the old nut was split in the weld. However, we re-cut the bolt at sea. When we had the old nut we had to use a 3-4 inch 6 foot 6-inch stay rod, and bend it over the keep and clamped it under the bed plate.

Having been at sea a number of years I have had much experience both practical and humorous. Once, in going up to Buma on the Congo River in April, we struck on a sand bank. Of course we had to get a kedge anchor out. We fastened the anchor under the jolly boat and pulled it out aft and dropped it into the dark blood-colored river. Shortly afterwards the anchor came to the surface in the mouth of a hippopotamus, which towed the ship off the bank. But we had to lose the anchor.

Stratford. Machinist.

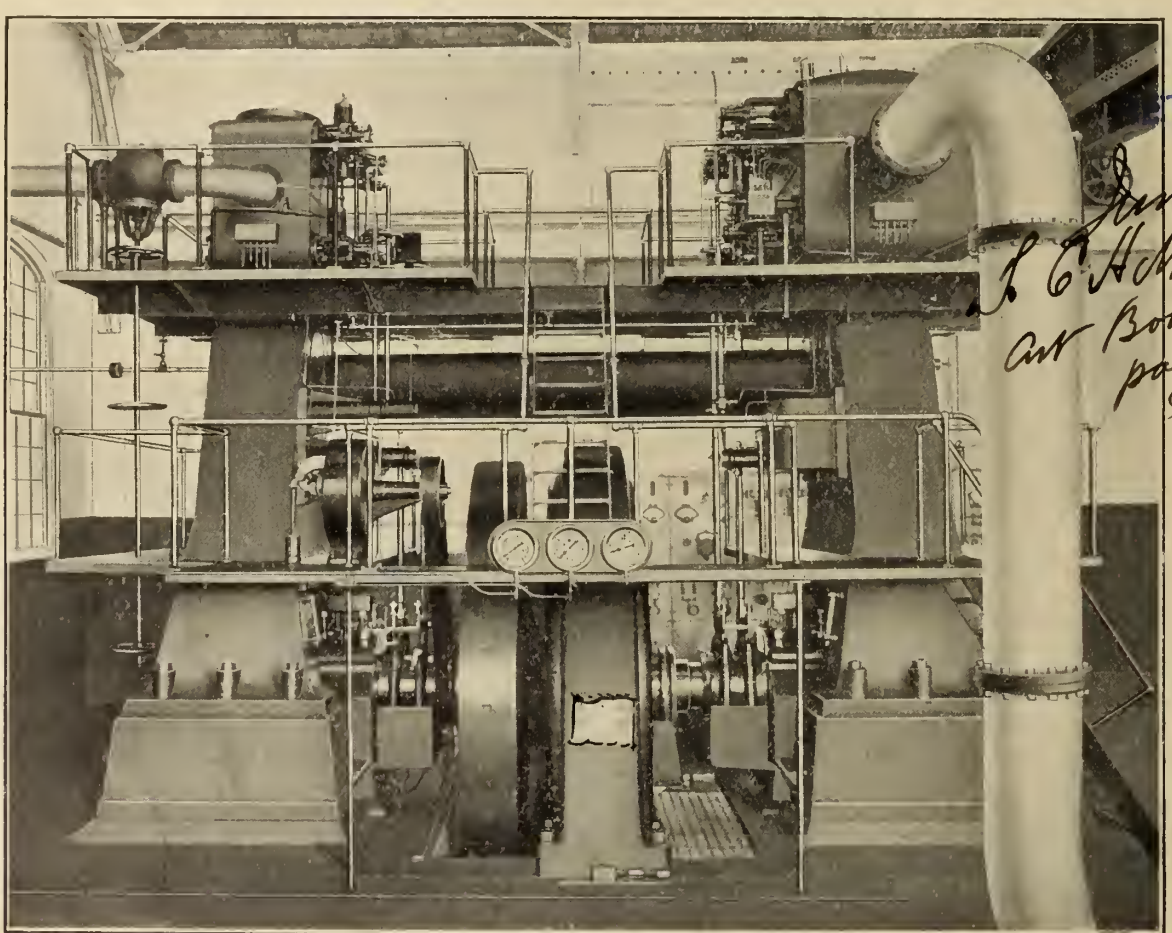
Power and Transmission

Steam Gas Electricity Compressed Air Water

GOLDIE & McCULLOCH ENGINES.

THE accompanying illustration is of one of two vertical engines built by the Goldie & McCulloch Co., Limited, Galt, Ont., for the Dominion Iron & Steel Co., for their power house at Sydney, N.S. The valve motion of these engines is of the Corliss type, similar in construction to the standard for horizontal engines made by this company, with steam actuated dash pots. This style of dash pot enables the engines to be run at a higher rate of speed than is usual with this type of engine. Both high and low pressure cylinders are fitted with separate eccentrics for actuating the steam and exhaust valves, and the cut-off of both cylinders is under the control of the governor. This latter feature is essential to the proper regulation and economy of engines operating on a greatly varying load and is especially desirable in a case where direct driven alternating current generators are to be run in parallel. If the low pressure cylinder is not so controlled, but has fixed cut-off the division of load between the two cylinders will vary with every change of load, the high pressure cylinder carrying the greater proportion of the total at light loads, and the low pressure at heavy loads. As above stated the closing of the admission valves is accomplished by steam pressure. When the valve is opened an extension of the dash pot spindle is pushed into a small steam cylinder against pressure and when released the valve is closed rapidly, giving a sharp cut off. The necessary cushion is effected by an air cylinder placed at the opposite end of the dash pot spindle. The top of this air cylinder is adjustable so that the latch plate arm on the valve spindle can be made to come to rest at its proper place. The steam and exhaust valves are double ported. The valve seats are lapped out and the valves ground to gauge. The edges of the cylinder ports are planed in a special planer. The oiling is effected from a central reservoir with pipes leading to the various places to be oiled.

The diameter of the high pressure cylinder is 21 inches, the low pressure cylinder 42 inches, and the stroke is 30 inches. The speed is 150 revolutions per minute. The main bearings which are fitted with removable shells, are 14 inches diameter and 28 inches long. The crank pins are 6 3-4 inches diameter by 8 1-4 inches long. The fly-wheel is 12 feet in diameter and weighs 32,000 lbs. The total height of this engine above the floor line is 19 feet. The governor is of the "Rites" inertia type, and is es-



Goldie & McCulloch Vertical Engine.

RETURNED
June 27/06
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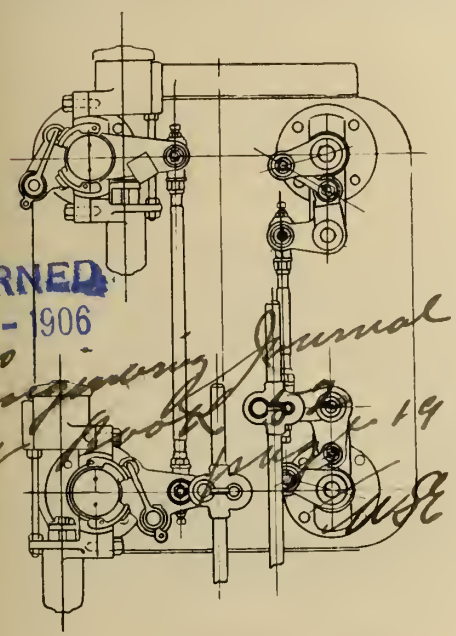
pecially adapted for the parallel running of alternators and for other purposes where extremely close regulation and quick action are necessary.

The engines are direct connected to sixty cycle alternating current generators of 600 K.W. capacity.

TURBINE PUMPS WITH BALANCED IMPELLERS.

THE continuing commercial development of turbine pumps is illustrated by the accompanying illustrations* of a line of turbine pumps recently brought out by the Buffalo Steam Pump Co., which line of pumps is to be made in Canada by the Canadian Buffalo Forge Co., Limited, Montreal.

The main feature of this line of machines is the use of back-to-back impellers (for approximate balance of thrust), supplemented by a carefully-designed arrangement of thrust-chambers



Valve Gear—Goldie &McCulloch Engine.

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JUL 5 - 1906
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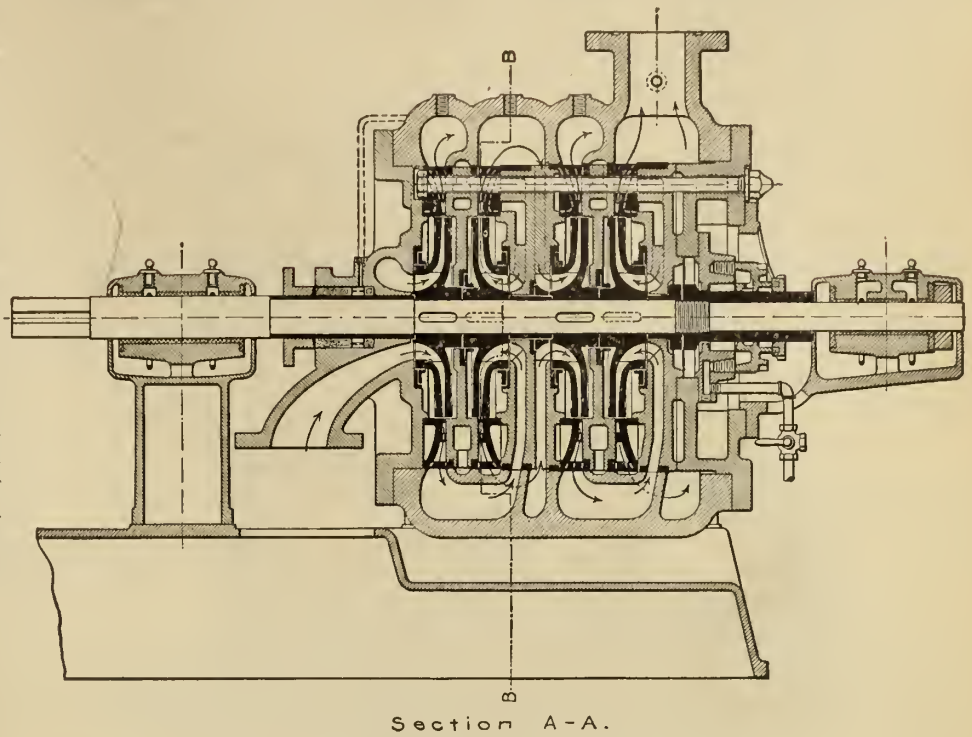
and Steam Engineering

quite similar to those frequently used in single horizontal-shaft Francis turbines. Balancing multi-stage turbine pumps by the back-to-back arrangement is not a new principle in this branch of machine design, but it has not found universal adoption. The fact that it makes more difficult the proper design of the water passages (with regard both to construction and to operation of the pump) doubtless has something to do with this. The pumps here described, however, show water passages of satisfactory simplicity and a general design that should prove cheap in machine work and assembling. Other important features of these pumps are, first, the separation of the functions of shaft-bearing and stuffing-box, and, second, the use of double stuffing-boxes to prevent leakage along the shaft.

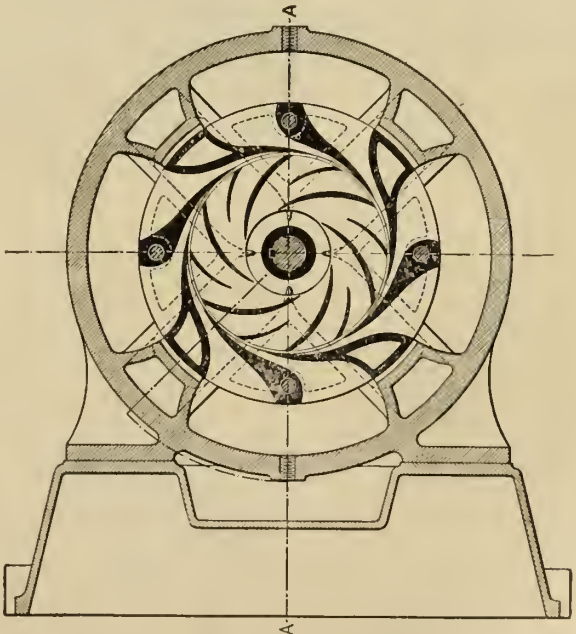
Figure 1, an axial section through a four-stage Buffalo turbine pump, shows the arrangement of the impellers or runners and of the water passages. The latter are more clearly explained in figure 2, a cross-section at right angles to the shaft. The pump consists of two main portions: (1) an outside cylindrical casing, in which are cored the discharge chambers of the several component turbines or "stages," and (2) within this casing an aggregation of plate-like guide castings, in which are formed the diffusion or guide vanes and the water passages leading from the discharge chambers to the suction sides of the respective following units. Running in completely enclosed circular spaces between these guide sections are the runners.



Section A-A.

Fig. 1—Longitudinal Section of Four-Stage Turbine Pump.

The aggregation of guide sections is assembled outside of the casing, with the runners or impellers put in place and keyed on the shaft as the assembling progresses, and is then bolted together by four through bolts in the manner



Section B-B.

Fig. 2—Transverse Section of Four-Stage Turbine Pump.

* For these illustrations Canadian Machinery is indebted to Engineering News.

shown in figure 1. The assemblage of working parts is set into the casing from one end, and is held in place by screws in the flange of the last section, which forms the end-plate of the pump

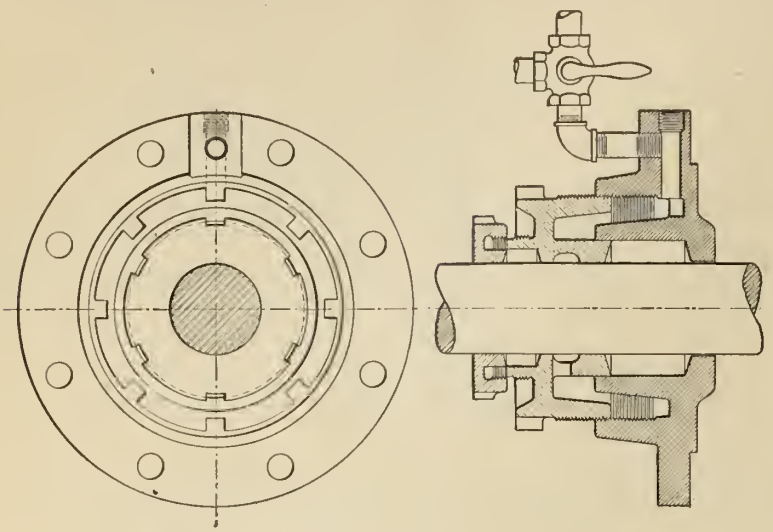


Fig. 3—Double Stuffing Box at Delivery End of Shaft.

ease at the delivery end. In order to facilitate the work of placing it into the casing, the several ring-shaped seats on the internal surface of the case are of successively smaller diameter. At each of these seats the corresponding guide section contains a brass ring turned to a force-fit in its seat, but small enough to pass easily through all seats farther to the right (in figure 1). The assemblage is thus easily entered in the casing up to the short distance of force-fit, when all the brass rings are simultaneously pressed home to a tight fit.

The shaft bearings are wholly outside of the case. The main bearing (at the left in figure 1) is in a pedestal set on the base-plate, while the out-board bearing is formed in a bracket bolted to the end-plate of the casing. The ends of both bearings are fitted with babbitted shoulders, against which bear collars on the shaft, to regulate end-play and to take up any slight thrust not balanced within the pump. Where the shaft passes through the casing, stuffing-boxes are provided. Thus the bearings are not required to act as packings, and the packing is not required to carry load, an arrangement conducive to long life of both packing and bearings.

The stuffing-boxes are, as already noted, designed with special view to preventing leakage. They are double-packed with two packings in series. The stuffing-box on the delivery side, whose construction is shown more in detail in figure 3, has two separate glands, the outer one being formed in the inner follower. The latter is so shaped as to form a leakage pocket between the two packings, and this pocket is drained by a drip-pipe; thus no pressure can accumulate in the space between the two packings, and the outer packing has to take care of only the moisture creeping along the shaft from the inner packing. The suction end stuffing-box is of somewhat simpler construction, having but one gland and one follower, with two packings kept apart by a separator. The space between the two packings is connected by a pipe to the delivery side of the first stage of the turbine, to form a water seal and prevent the leakage of air into the suction chamber.

Where the shaft passes through the stuffing-boxes it is protected by brass or composition sleeves, and a similar sleeve is placed over the section of shaft between the two pairs of impellers. This results in giving the shaft a complete non-corrosive covering from outside to outside of stuffing-boxes.

To balance the end thrust produced by the difference of pressures on the front and back of each impeller, thrust-chambers are formed between the outer faces of each impeller and the adjoining guide castings, in which water from the delivery side of the respective impeller accumulates and produces a thrust proportionate to the exposed area of impeller face. These chambers are sealed off from each other by brass packing rings of special construction, which prevent the flow of water from the high to the low pressure spaces outside of the impellers.

Figure 4 is a detail section of such a seal ring. The ring, which has a ground fit on the hub of the impeller, is held from rotating, but has a slight radial play, so that it can adjust itself to the eccentricity and vibration of the rotating parts. A brass seating ring is fixed in a recess in the face of the guide section, and the packing ring is held against this seat by three studs which pass through slotted holes in the packing ring. The long axis of these slots is radial to the shaft, so that the packing ring can shift slightly in all directions in a plane normal to the shaft. The brass seat against which the packing ring bears insures a tight joint on the radial face, and the ground fit of the packing ring over the impeller hub prevents leakage and loss of pressure through the circumferential joint.

Each thrust-chamber, being in com-

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JUL 9 - 1906

Simonds Canada Saw Co.—Plant where Large Gas Plant is being Installed.]

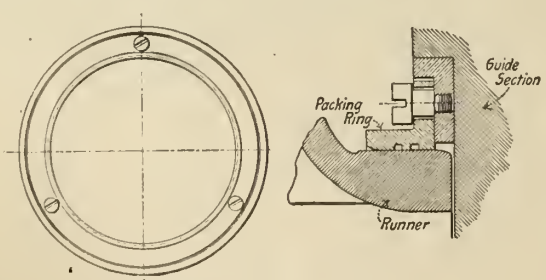


Fig. 4—Detail of Seal Ring for Thrust Chamber.

munication with the delivery side of its impeller by way of the radial clearance between impeller and guide vanes, contains water at the delivery pressure of that impeller. The two chambers produce thrusts in opposite direction, of an amount equal to their difference in area. This difference, in the present design, is so adjusted that for each pair of impellers the resultant thrust-chamber pressure just balances the difference of inlet opening pressures.

The balancing is thus accomplished separately for each pair of impellers, instead of providing a single balancing device for the entire pump, as is sometimes done. The method of thrust-chamber balancing is not restricted to pumps with back-to-back impellers, but can be applied just as well to any arrangement of runners. In fact, it is used also in the single-runner single-stage pumps of the same makers. In next month's issue of Canadian Machinery something will be said concerning the efficiency of these pumps as shown in two tests made.

GAS PLANT EXTENSIONS.

IN the June number was published a description of the Campbell gas engine and suction plant operating at the Simonds Canada Saw Co., St. Henri, Montreal. This company, after conducting very careful tests with this engine and gas plant, and keeping careful check of its performances generally, have decided to make all extensions in the way of power along this line, and have ordered from Wayland Williams & Dadson, 321 St. James street, Montreal, the Canadian agents for the Campbell Gas Engine Co., a large gas engine of 150 b.h.p., and a gas plant of 600 b.h.p. The gas plant is to supply gas for the two engines, and also for furnace work in the factory.

THE "NATIONAL" GAS ENGINE.

THE "National" gas engine, made by the National Gas Engine Co., Limited, Ashton-under-Lyme, Eng., is being placed on the Canadian market by the Economic Power, Light & Heat Supply Co., York street, Toronto, and the engines having some features not embodied in Canadian engines, a description of them will be of interest.

The engines are built on the "Otto" cycle, but many improvements have been made upon the original "Otto" engine. The engines are built for all classes of stationary engine work, and engines can be supplied to run on coal gas, natural gas or producer gas. Complete electric lighting plants can be supplied, consisting of a slow-speed dynamo, direct connected to engine. Although all the engines are built upon the same principle, in detail construction they differ very much, according to the class of work they are designed to perform.

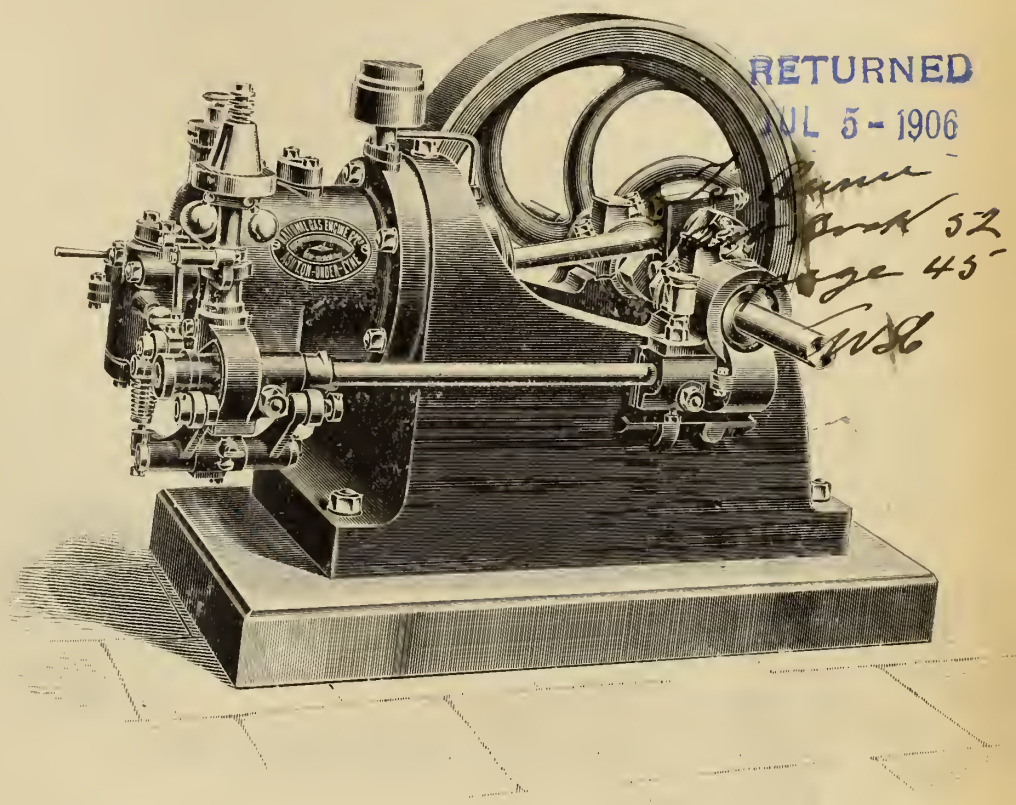
The engines are supplied with either the hot tube ignition or with the electro-magnetic. The ignition tube and the tube holder are something special. By a special patented holder the firm have found it possible to utilize the porcelain or clay tubes without fear of the latter breaking owing to unequal expansion of metal and porcelain. The system of electric ignition is by means of wipe spark, current being supplied by a magneto machine.

Engines of all sizes are supplied with loose liners for the cylinders and these when worn can be replaced at comparatively small cost, obviating the necessity of re-boring the cylinder. The governor is the fly-ball type, operating to regulate the gas supply according to the load. The valves are arranged so as to be easily cleaned and ground when required. The exhaust valve and spindle guide are part of the main casting, instead of being bolted on as in many engines. The air and gas valves are in a separate casting bolted to the back of cylinder. All valves have removable covers with ground joints.

The piston is lubricated from a sight feed lubricator; the bearings are constructed with large oil wells with syphon wicks; and the crank pin and piston pin are lubricated by patented devices. The oil cup for the crank pin bearing is attached to the engine bed close to the crank bearing. The oil from the cup passes down a tube and locates itself upon a circular ring which is part of the crank brasses. A steel wiper trailing around this ring conveys the oil to the crank pin brasses. For the lubrication of the piston pin a cup is formed on the top side of the connecting rod steps, and a tube inserted in the piston immediately above it. Oil passes from the cylinder lubricator to a recess on the upper side of the piston, and thence through the tube to the piston pin brasses.

Special types of piston pin and connecting rod end are used. A shaped head is formed solid with the connecting rod and two half bearings embrace the piston pin and are bolted to connecting-rod head by special bolts.

The illustration shown is of a type of engine specially designed for small units, being equipped with all the modern improvements.



National Gas Engine.

RETURNED
JUL 5 - 1906

The West Branch Jocko Co., Limited, Hawkesbury, Ont.; capital, $20,000; purpose, to construct and maintain dams, slides, piers, etc., for the transportation of timber, etc., down the Jocko River, and to collect a toll for the use of same. Directors are: H. Robinson, T. T. McWaters, Hawkesbury; H. K. Egan, R. L. Blackburn and A. Blackburn, all of Ottawa.

ABOUT CATALOGUES

By mentioning Canadian Machinery to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

Helpful Hints on Farm Power— A booklet published by the Fuller & Johnson Mfg. Co., Madison, Wis., on gas engines as adapted for farm use, discussing their frost-proof engines for outside use the year round.

Gasoline Engines. A catalogue published by the Fuller & Johnson Mfg. Co., Madison, Wis., describing and illustrating their frost-proof gasoline engines. The catalogue is well illustrated; size, 6 x 9 inches.

Finishing Armature Spiders. A leaflet from the Gisholt Machine Co., Madison, Wis., illustrating and describing the finishing of armature spiders on their 24-inch standard turret lathe, motor driven. The engravings are excellent.

Small Power Motors. Circular No. 1128 of the Canadian Westinghouse Co., Limited, Hamilton, illustrating and describing small motors for application to work such as coffee mills and ice cream freezers.

Electro-Static Volt Meter. Circular No. 1130, of the Canadian Westinghouse Co., Limited, Hamilton, illustrating and describing in detail their electrostatic volt meter for the measurement of high voltages.

Foundryman's Note Book. A neat little foundryman's note book distributed by F. L. Crobaugh, M.S., Cleveland, at the recent foundrymen's convention in that city.

Exhaustive Arguments. A leaflet issued by the Ohio Blower Co., Cleveland, O., telling about their "Swarwont" cast iron exhaust heads.

Money Savers. A booklet issued by the Cleveland Wire Spring Co., Cleveland, O., describing and illustrating their steel receptacles for shop purposes. These include receptacles for tools, bolts and nuts, machine parts, oils, sand and many similar things.

Maywood Molding Machines. The 1906 catalogue of the Maywood Foundry & Machine Co., New York, illustrating and describing the Maywood molding machines. The illustrating is excellent and the good points in the machines are pointed out clearly and concisely. Size, 6 x 9 inches.

A Model of Simplicity. A booklet issued by the Ohio Blower Co., Cleveland, O., giving an original and interesting account of the principle of the "Swartwont" steam separator.

Economy. A booklet sent out by the Osborne Mfg. Co., Cleveland, O., pointing out the good points in their wire wheel brushes, and the economy obtained by their use.

Turbines and Generators. Bulletin 1504 of Allis-Chalmers-Bullock, Limited, Montreal, giving a very complete description of the Allis-Chalmers steam turbines and generators. Special attention is directed to the arrangement of "balance pistons" on page 9 of the bulletin and the arrangement of "blading" on page 13. The bulletin is well illustrated and is of great interest.

Saws. The general catalogue of the Tabor Manufacturing Co., Philadelphia, illustrating and describing the Taylor-Newbold Saw, which saw is adapted to meet the requirements of steel foundries, rail mills and structural steel works. The catalogue is 6 x 9 inches, and is excellently illustrated.

Chain Hoists. A booklet issued by the Chisholm & Moore Mfg. Co., Cleveland, O., illustrating and describing their chain hoists and I-beam trolleys.

Tabor Molding Machines. A very handsome catalogue gotten up by the Tabor Mfg. Co., Philadelphia, illustrating and describing their power ramming split pattern machines and their vibrator frame power ramming machines. The catalogue is well illustrated with cuts of the machines themselves and also of the work done on them. Size, 6 x 9 inches; cloth bound.

Choosing a Concrete Mixer. A booklet printed by the Municipal Engineering and Contracting Co., Chicago, containing an article by Clarence Coleman, M. Am. Soc. C. E., on "The Efficiency of Concrete Mixing Machines." The booklet is well illustrated.

Thermit. A booklet issued by the Goldschmidt Thermit Co., 43 Exchange Place, New York, on "Thermit and What You can do With it." The booklet reviews in an attractive style the current thermit practice, and is illustrated with sketches of the different processes.

Diamond Flask and Core Machine. A circular illustrating and describing the Diamond standard taper snap flask and the Diamond universal core machines, made by the Diamond Clamp & Flask Co., Richmond, Ind.

Convention Car Builders' Association. The Ingersoll-Rand Co., 11 Broadway, N.Y., have published a little booklet containing photos of the officers of the company and the salesmen in the different large cities. It is also a souvenir of the recent convention of the American Railway Master Mechanics' Association and the Master Car Builders' Association.

The Standard Sand & Machine Co. The general catalogue of the Standard Sand & Machine Co., Cleveland, O., illustrating and describing their labor saving machinery for foundries and also their concrete mixers, gas and gasoline engines, etc.

Foundry Chaplets. A booklet issued by W. W. Lindsay & Co., Philadelphia, Pa., describing and illustrating the method of manufacture of the Lindsay chaplets and anchors.

Burk Machinery Co. Circulars of the Burk Machinery Co., Cleveland, O., illustrating and describing their machine tools including sensitive drill presses, milling machines, index centres, miller and drill press vise, tapping machines, oil forges, etc.

Gas Plants. A catalogue issued by Crossley Bros., Limited, Openshaw, Manchester, Eng., illustrating and describing their suction and pressure gas plants. It is well illustrated with half tones showing installations and also illustrations showing sectional views of the plants. Size, 9 1-2 x 11 inches.

Foundry Appliances. A general catalogue gotten out by the W. W. Sly Mfg. Co., Cleveland, O., illustrating and describing their foundry appliances. This catalogue shows their latest achievements in tumbling mills and other foundry appliances, including incorporators, exhaust fans, sand mixers, dust arrestors, etc. The catalogue is supplemented with several foundry roof designs, which should prove of considerable interest to anyone interested in foundry building. The catalogue is well illustrated and is 6 x 9 inches in size.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

REVERSING VALVE FOR GAS FURNACE.

BEING radically different from valves hitherto used in connection with gas furnaces, the type developed by Mr. J. A. Dyblie and placed on the market by the Morgan Construction Co., of Worcester, Mass., is of interest.

The construction and operation of the valves are illustrated in the accompanying drawings. Fig. 1 shows a plan and elevation in one of the operating positions. Fig. 2 shows valve raised and turned 90 degrees, and ready to drop into the water seal to reverse the path of the gases, as shown in Fig. 1. The openings 1 and 3 are connected to the furnace, the opening 4 to the stack, and 2 to either the gas or air supply. There is no overhead flue connection to a valve of this character. Over the openings to the flues 1, 2, 3 and 4, is placed an inverted cylindrical box, provided with a single partition running across on the diameter. This partition is shown at (A) in the elevation Fig 1. The edges of the box and of this partition dip into the water seal casting (T), thus preventing any escape of the gases to the outside air. With the valve in the position shown in Fig. 1 there is a free opening between ports 1 and 2, and between 3 and 4. Thus the passage of the gas or air will be from 1 to 2, and thus into the furnaces. It returns through 3 into 4 and thence to the stack. If the valve, however, is turned through an arc of 90 degrees so that the partition (A) rests along the line (YY) in the plan, Fig. 1, the passage of the gas or air would be from 2 to 3 and from 1 to 4 and thence to the stack.

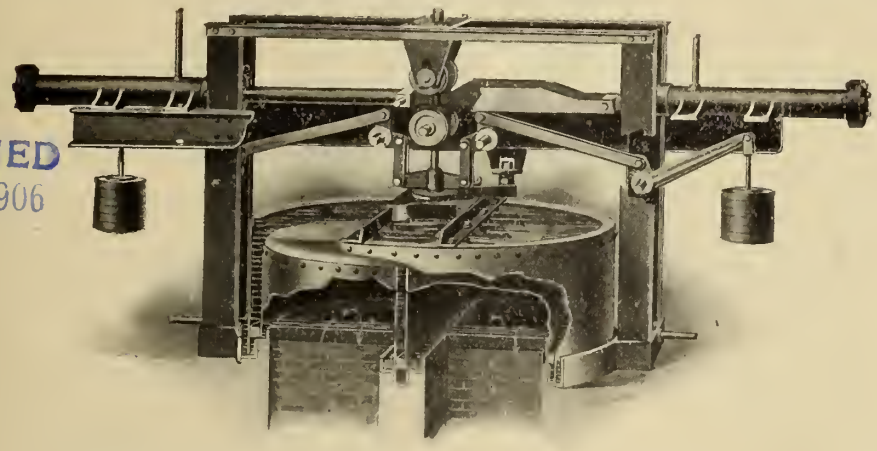


Fig. 1. The Dyblie Reversing Valve.

To reverse the valve it is necessary to raise the valve body a sufficient distance to allow the centre partition to clear the edges of the water seal before the valve is turned. The edges of this centre partition are accordingly made shorter than the lips at the circumference, as shown in Fig. 2. This permits the valve to be turned without breaking the water seal. The mechanism by which this is accomplished is as follows: The weight of the valve is borne by the wheels (B), attached to the spindle (C), which is arranged to permit a free vertical movement. The wheels ride on cam bars (D), which are operated by the two cylinders (EE) on either side of the valve. If the cam bar be pushed one way or the other the wheels (B) will ride up on the cam, and the entire valve be lifted.

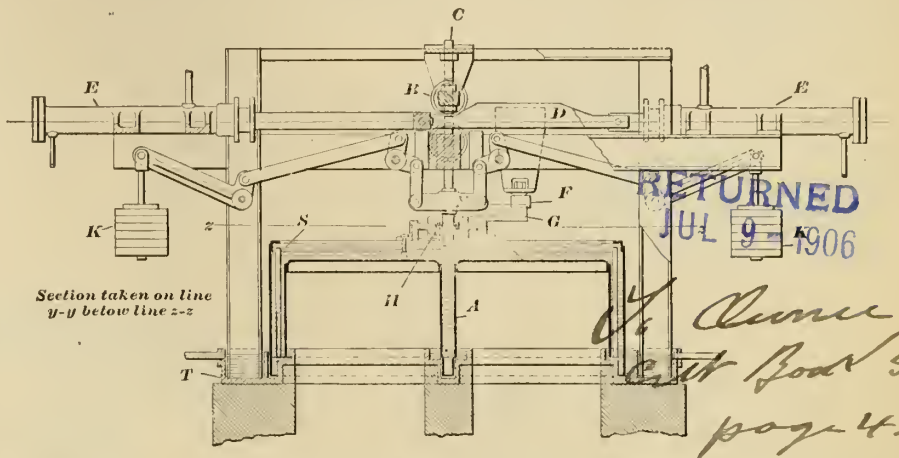


Fig. 3.—Valve in Elevation.

The turning of the valve is accomplished by the roller (F), which is rigidly connected to the cam bar (D). The roller engages the channeled arm (G), which is attached to the valve. As (D) is moved the roller (F) engages the arm

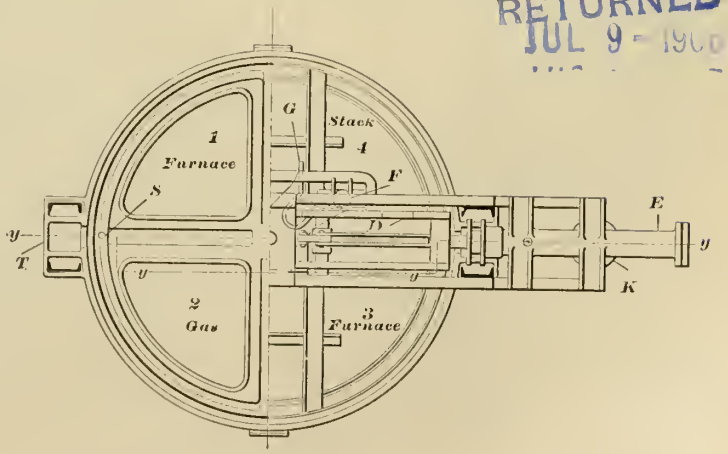
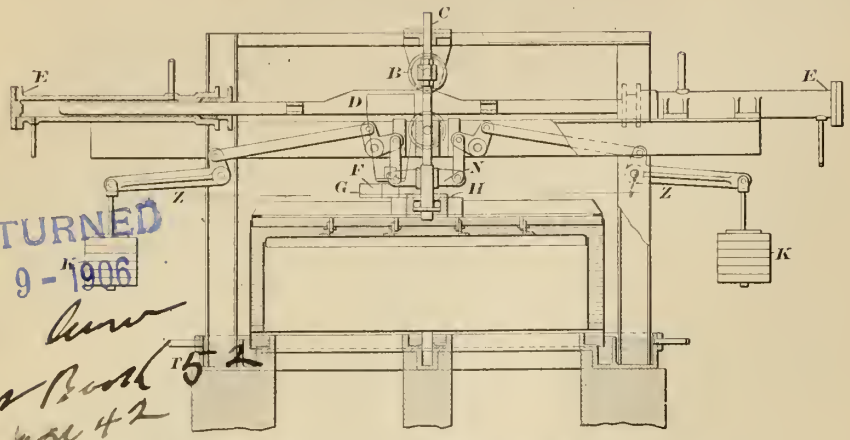


Fig. 2.—Plan of Valve.

RETURNED JUL 9 - 1906

(G) and turns it, and consequently the valve, through the necessary arc. As the cam bar reaches the limit of its travel, the wheels descend on the opposite incline, and the valve settles in its new position. The process is repeated in the opposite direction on reversing the valve. The use of two operating cylinders makes it possible to provide an operating mechanism without any inside packed joints. The valve is counterweighted by the weights (KK). The ball-bearing collar (H) at the centre of the valve renders the turning of the same comparatively easy.

The valve itself is surrounded by a second cylindrical box, open at the top, which is filled with water and forms a water jacket.



Section taken on line y-y, below line Z-Z but with valve turned 90°

FIG. 4—Valve Reversed.

RETURNED
JUL 9 - 1906

JOHNS PATENT BEAM SHEARS.

THE Johns Patent Beam Shears, made by Henry Pels & Co., 68 Broad street, New York, are shown in the accompanying illustrations. In bridge and structural iron works, boiler shops, ship yards, etc., there is a continual demand for structural shapes of different lengths, and this condition creates a demand for some kind of rapidly cutting-off tool. For this purpose there are cold saws, high speed saws and hydraulic beam shears, besides the Johns Patent Beam Shears. Cold saws do good work and require practically no attention, but they are slow. The drawbacks to the high speed saws are the large amount of power they require, and the roughness of the cut made. The hydraulic beam shears cut nothing but beams and channels, and the knives have to be changed for each section.

It was with an idea of overcoming these difficulties experienced with existing methods of cutting off structural shapes, that the Johns Patent Beam Shears were devised. The advantages claimed for these shears are briefly: Quickness of doing work, small amount of power used, same knives do all kinds of work, i.e., they cut angles, tee-bars, or zee-bars, as well as beams and channels. The quickness of doing work is shown in the fact that a 15-in. beam can be cut in 15 seconds. The small amount of power used is due to the patent lever mechanism used in the shears. The 24-in. beam shear requires 15 h.-p.

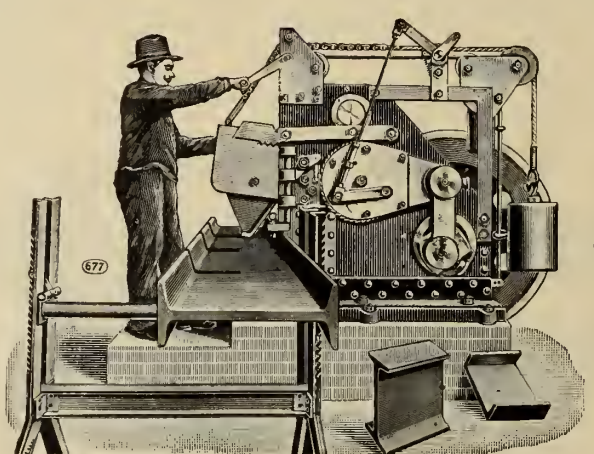


Fig. 1.—Johns Patent Beam Shears.

As may be seen from figure 1, the shears are built with a frame of steel plates, which accounts for the comparative lightness of the shears. All the parts are comparatively simple and are easily accessible.

Figure 2 shows a trimming attachment for the shears, which will cut off straps as narrow as $\frac{1}{4}$-in. from structural shapes. The shapes as delivered from the rolling mills are usually slightly longer than specified, and hence the necessity for trimming. The shears can also be fitted with coping knives for cutting off flanges of beams, channels, etc.

Figure 3 illustrates the way in which the different shapes are cut. The operation of the shears is simple. The shape to be cut is placed upon the lower knife block. The upper knife is lowered, the machine thrown into gear, and by pressing down the handle at the left side of the machine the knife is forced through the shape. Angles and tee-bars are cut off at one stroke, but beams, channels and zee-bars must be turned over for a second cut.

RETURNED
JUL 9 - 1906

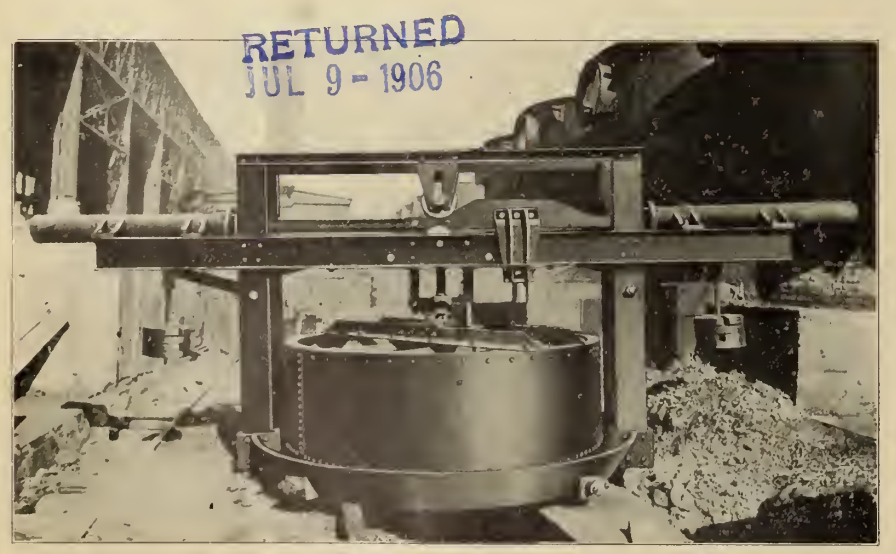


FIG. 5.—Valve in Process of Erection.

A SELECTOR SWITCH.

THE accompanying cut illustrates a selector switch made by the Toronto & Hamilton Electric Co., Hamilton, Ont. This is used largely on high potential circuits to open the main line to affect repairs, make alterations, etc. It is also used in main and sub-stations as a selector switch for connecting up transformers. It is intended to ensure the safety of the operator, it being opened from the ground by a long hooked pole.

RETURNED
JUL 5 - 1906

High Tension Switch.

SMART-TURNER DUPLEX PUMP.

THE accompanying illustration shows a duplex outside packed pump, provided with pot valves, as recently designed by the Smart-Turner Machine Co., Limited, Hamilton, Ont. It is particularly adapted to marine service, and as is seen, while the pump is outside packed, the plungers do not project outside the cylinders, thus avoiding any chance of the engineer being struck on the leg by a projecting plunger. Each valve is in its own pot, so that any one may be taken out by removing only two nuts. Any drip from the plunger glands is caught in a pan, so arranged that it may be carried away in a pipe. The steam end of the pump is of the standard duplex pattern. The whole pump takes up less floor space than the end outside packed pattern, which is so well known.

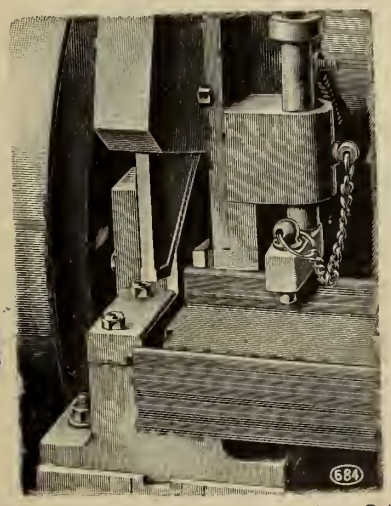


Fig. II.— Trimming Attachment: Johns Patent Beam Shears.

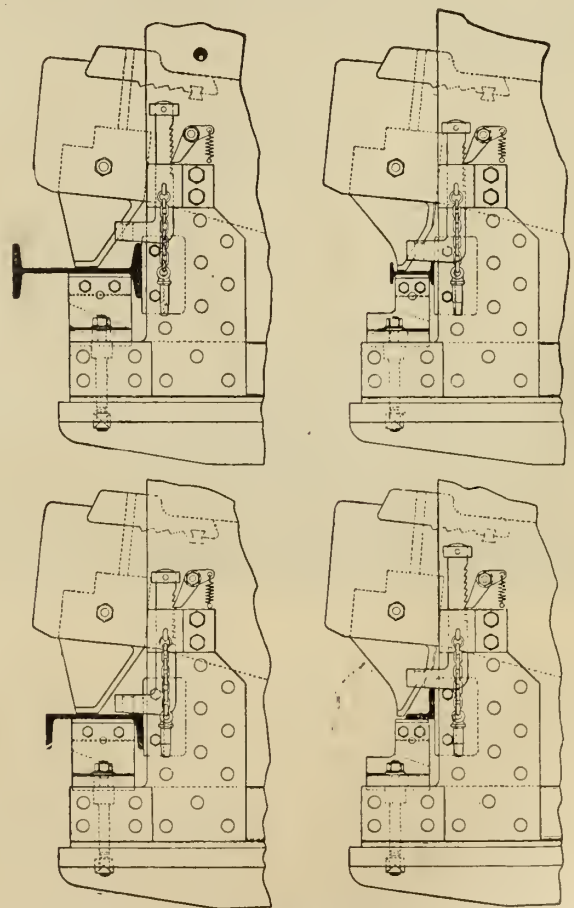
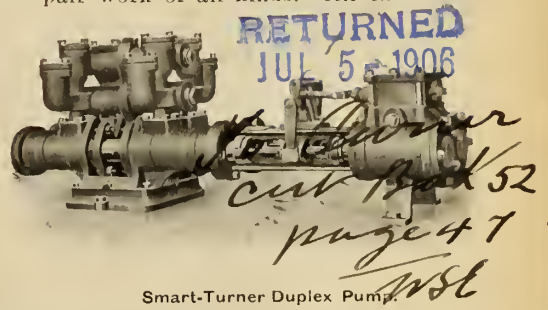


Fig. III.—Johns Patent Beam Shears, Showing Manner of Shearing Different Shapes.

NEW ELECTRIC FIRM.

The Electrical Machinery Co., of Toronto, have recently started up business at 115 Simcoe street, Toronto. The members of the firm are A. J. Phillips, manager; F. Marson, superintendent, and J. H. Harris, secretary-treasurer. The firm are making dynamos and motors, the machines being of their own design, and also do electric machine repair work of all kinds. All three members of the firm have had considerable experience in the design and construction of electrical machinery, having been connected at different times with several Canadian firms making dynamos and motors. They intend building up their business upon the merits of the machines they make, and consequently they spare neither trouble nor expense in the perfecting of them.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JUL 5 - 1906

Smart-Turner Duplex Pump.

A Town Industrial

The Rise of a Manufacturing Centre in the Face of Adverse Conditions

By a Staff Correspondent

IN spite of the fact that the Town of Oshawa seems endowed with all the natural disadvantages with which Providence ever graced a community it has risen from an obscure hamlet to a manufacturing centre whose industries are known as household words throughout the Dominion. Without water-power, without natural gas, without cheap fuel, without natural transportation facilities—in fact, sans anything that goes to make for the building of an industrial community— this wonderful town has developed and prospered. As such it continues a reproach to better favored but less enterprising centres. The question at once arises "How was this accomplished?" It seems like a riddle of the Sphinx. The answer is found in the lives of a few remarkable men, some of whom are to-day living monuments to the possibilities of individual effort. Oshawa is further favored by having as a citizen a genius like Dr. Kaiser, whose courtesy in supplying much of the information herein must be acknowledged.

To go into history, it is apparent that from the start the town's very existence is due to men of powerful personality. These men have made a town distinguished for successful manufacturing industries. The first man to concern himself with the place in an industrial way was J. B. Warren. This was early last century. A fair water-power was at that time available and here he built a mill.

This water-power was the town's first and only attraction. The first manufacturer was A. S. Whiting, who was followed by a leader in the person of Joseph Hall, who was followed by F. W. Glen, his son-in-law, and T. J. Hall. As these men went down two men arose from the ruins, these being Hon. T. H. Gibbs, formerly secretary of state, and his brother, W. H. Gibbs. Throughout their lifetime these two were the mainstay of the struggling hamlet of Oshawa. During a period of depression in manufacturing they became financially involved and were unable to tide over the depression. When they were prosperous they did much for the town and any progress made twenty-five or thirty years ago was due to them.

As the Gibbs brothers were shifting from the arena of activity there sprang up two most remarkable men the Town of Oshawa has yet seen, men who have accomplished for Oshawa what others were unable to do. These are John and W. F. Cowan, who are known throughout Canada in industrial and financial circles. To their business ability, enterprise and brain power the present prosperity of Oshawa is due without any doubt. These men established some of the greatest of Oshawa's industries, but in starting the Western Bank, which constitutes the hub around which the whole wheel of Oshawa spins, they rendered the greatest service.

Chelsea Falls, on the Gatineau River.

Oshawa's Hub.

The Western Bank was started in 1882 as a local financial centre, but has since established branches in many of the neighboring counties. The president is John Cowan and the board of directors includes W. F. Cowan. The man-

aging director is P. H. McMillan, and to his close application to business much of the success of the bank is due.

It may be surprising to think that the influence of a bank should have been the means of creating industries from the fact of its rare occurrence. Being the head office and in close touch with all her people, the management of this financial institution were in a position to aid and build up when a branch manager under the present laws of banking would be powerless to assist. It is a broad statement, but true, that with one exception the important manufacturing interests of Oshawa to-day owe their present status to the helping and guiding hand of the Western Bank. In earlier days a branch office of another bank was started there but did nothing to build up the town industrially and later closed its doors.

The principle on which the town has been built up lies in the fact that since the bank was started no man of character and ability desirous of manufacturing in Oshawa has been refused assistance by the bank. In spite of this principle, few bad debts have been made. In one case a firm was in bankruptcy when the town bank took hold and it is now one of the largest organizations of its kind. Mr. McMillan stated that the bank never hampered an account and so did not upset the calculations of worthy manufacturers.

Some Industries.

Whilst it was mentioned at the outset that Oshawa was without natural transportation facilities, it was meant that the town had neither water connection nor situation on the main line of a railway, yet manufacturers are specially favored with an electric line running to Oshawa Junction and which has a switch running to every plant.

Some of the foremost industries in the town include the McLaughlin Carriage Co., the Pedlar People, manufacturers of roofing and sheet metal goods; the R. S. Williams Piano Co., the Schofield Woollen Mills, the Ontario Malleable Iron Co., and the Oshawa Steam & Gas Fitting Co. In addition to these there are the canning factory and several other metal industries. The Ontario Malleable Iron Co., which is now employing between four and five hundred men, is making arrangements to double its capacity and will in the course of a year employ twice as many men. The same is true of the Oshawa Steam & Gas Fitting Co., who now employ about three hundred hands.

Many a town in the country with infinitely better facilities for manufacturing, has been at a standstill when Oshawa has gone ahead. Every town has men of latent resource who, if they have the courage and energy, could live to have the satisfaction of having seen their native or adopted town become an important industrial centre through their efforts. May the example set by the princes of industry in Oshawa be followed in other centres.

ENGINEERING NEWS

AND SOCIETY NOTES

SOCIETY OFFICERS.

Canadian Mining Institute.

President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer Lamb, Victoria, B.C.; treasurer, J. Stevenson Brown, Montreal.

Toronto Branch A. I. E. E.

Chairman, R. G. Black; vice-chairman, K. L. Aitken, secretary, R. T. McKeen.

Marine Engineers.

Grand president, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N.B.

Canadian Electrical Association.

President, R. G. Black, Toronto; vice-presidents, R. S. Kelch, Montreal, W. R. Ryerson, Niagara Falls, Ont.; secretary-treasurer, T. S. Yonge, Confederation Life Building, Toronto.

Canadian Association of Stationary Engineers.

President, Wm. A. Sweet, Hamilton: vice-president, Jos. Ironsides; secretary, Wm. Outhwaite, Toronto; conductor, Ed. Grandbois, Chatham; doorkeeper, Chas. Kelly, Chatham.

Ontario Association of Stationary Engineers.

President, A. M. Wickens, Toronto; vice-president, W. A. Sweet; board of directors, W. Blackgrove, W. A. Sweet, A. M. Wickens and A. E. Edkins; treasurer and registrar to be appointed by board of directors.

Canadian Railway Club.

President, S. King; secretary, James Powell, chief draughtsman motive power department, G. T. R.; treasurer, S. S. Underwood, chief draughtsman car department, G. T. R.

Engineers' Club of Toronto.

President, F. L. Sommerville; treasurer, W. J. Bowers; secretary, Willis Chipman, Rooms 96 King St. W.

Canadian Society of Civil Engineers.

President, H. D. Lumsden, Ottawa; vice-presidents, M. J. Butler, Ottawa; C. B. Smith, Toronto; W. M. Walbank, Montreal; secretary-treasurer, C. H. McLeod, Rooms, 877 Dorchester street, Montreal.

Society of Chemical Industry

Chairman, Prof. W. H. Ellis; vice-chairmen, H. H. Van Der Linde, Milton; H. Hersey, A. McGill; hon.-secy., Alfred Burton, 11 York Street, Toronto.

Ontario Land Surveyors.

President, Otto J. Klotz, Ottawa; vice-pres., Thos. Fawcett, Niagara Falls; secy.-treas., Capt. Killaly Gamble, Toronto.

Engineers' Society, S.P.S., Toronto University.

President, K. A. McKenzie; vice-pres., B. J. McGugan, rec. secy., A. M. Damn; treas., G. E. Quance; cor. secy., A. E. Jupp.

Convention of O. A. S. E.

At Hamilton on May 28, the Ontario Association of Stationary Engineers held its annual convention, with about sixty members present. The chief topic of discussion in convention and in private conversation, as was to be expected, was the compulsory license law, and there appeared to be general satisfaction with the measure.

From the retiring president's report it would appear that the association have had a prosperous year, a large number of new certificate holders having been added to the lists. It was also pointed out in the report that the Ontario Association of Stationary Engineers had not been legislated out of existence as was supposed by some, but that the "Act Respecting Stationary Engineers" under which the association had been incorporated had merely been amended by the new bill by the addition of several new sections, the chief feature of the amendment being that after another year the board of management will be appointed by the Government instead of being elected by the association.

The election of officers resulted as follows: President, A. M. Wickens; vice-president, W. A. Sweet (acclamation); board of examiners, W. Blackgrove, W. Sweet, A. M. Wickens and A. E. Edkins; treasurer and registrar to be appointed by the board of examiners.

* * *

Air Brake Convention.

An important convention of the American Air Brake Association was held in the Windsor Hotel, Montreal, from the 5th to the 8th of June. About two hundred and fifty members, comprising representative steam railroad men from the operating departments of all the leading roads of America came together for this convention, which is the first ever held by the association outside the United States.

The programme of entertainment included the annual ball, which was held in Stanley Hall on the evening of June 5, a trip to Ottawa by special train on June 6, and a trip to Quebec, where the delegates were taken on a special Intercolonial train, Thursday afternoon, June 8. While in Quebec the visitors were taken care of by the Quebec Light & Power Co., who entertained them at lunch at the Kent House.

During their visit in Montreal, the visitors had extended to them the courtesies of the Montreal Street Railway Co., each delegate receiving a complimentary book of tickets.

Milling Cutters : How They are Made, Used and Abused.

By John Edgar.

ARTICLE III.

WE have now come to what will prove to be the most interesting part of the series, the milling of the cutter. The machine that is generally used in making milling cutters is

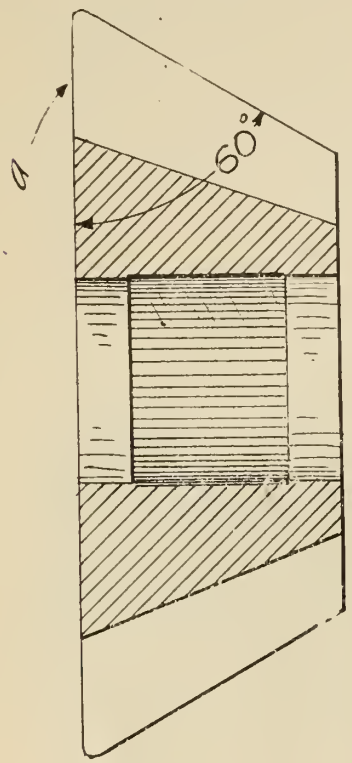

Fig. 10.

the Universal milling machine, although straight or plain cutters which do not have spiral teeth may be cut on a plain machine, when it is provided with centres for holding and indexing the work.

The work is held between the centres of the spiral head in a manner similar to the methods used in ordinary lathe work, care being used to make certain that the arbor runs true, is well supported on the centres and that the dog is locked in place to prevent any back lash which would otherwise occur. Most machines are provided with a carrier into which the tail of the dog is slipped and secured by set-screws.

When many cutters are made having the same size hole it is good policy to provide an arbor with a shank fitted into the main spindle of the dividing head. This makes a much stiffer and an altogether better arrangement.

In selecting the cutters for use in cutting the teeth of milling cutters, much, of course, depends on the style cutter being made. In making ordinary plain mills a single angle cutter like figure 10 could be used. This style cutter does not produce the best class of work but it is simple and cheap, which qualities appeal to a great many users. They may be improved by making the sides or ends of the cutter hollow or concave so as to reduce the drag to the minimum. Much better results can be obtained when teeth are cut on the side (a). Even then when this straight face is used to cut the radial face of the cutter it leaves a series of scratches due to the untruth of the cutting edges. These cutters are furnished regularly with angles of 45, 50, 60, 70 and 80 degrees, varying in size from $2\frac{1}{2}$ to $3\frac{1}{2}$ inches diameter, usually with a 1-inch hole which is generally the standard size hole for this kind of work. It is much better to have but one size of hole than to have a number of sizes for which there are no suitable reasons.

Another item which has caused unlimited trouble is the key-way. Many cutters having the same size hole may be found with different size key-ways. In table III is given the standard adopted by the cutter manufacturers and which represents the present practice of the best makers of cutters to-day. The key used is of square stock.

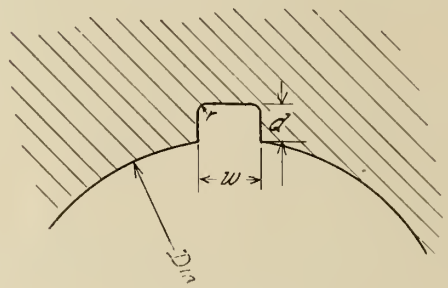

TABLE III.

STANDARD KEYWAYS FOR CUTTERS.

Diameter of hole.			Width of key. (w)	Depth of keyways. (d)	Radius (r)
3-8″	to	9-16″	3-32″	3-64″	.020″
5-8	to	7/8	1/8	1-16	.030
15-16	to	1-1/8	5-32	5-64	.035
1 3-16	to	1 3/8	3-16	3-32	.046
1 7-16	to	1 3/4	1/4	1/8	.050
1 13-16	to	2	5-16	5-32	.060
2 1-16	to	2 1/2	3/8	3-16	.060
2 9-16	to	3	7-16	7-32	.060

If an attempt is made to use the single angle cutter in milling spiral teeth a result such as shown in figure 11 would be obtained. It is easily seen that this would not be satisfactory. The trouble is caused by the twist of the spiral. This eliminates this style cutter from being used on this class of work. A spiral groove having a straight radial side cannot be produced by a cutter which has a cutting profile composed of lines any of which are perpendicular to the axis of the cutter. A cutter suita-

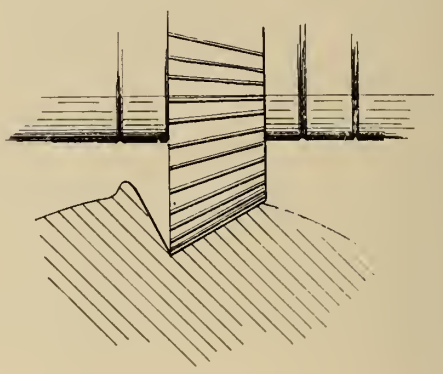

Fig. 11.

ble for spiral milling must have a double angle as shown in figure 12.

These double angle cutters are usually made with one cutting edge of 12-degree, and the other at 40, 48 or 53-degree angle, the one to use depending on the size of the cutter and the number of teeth it contains.

In table IV is given the angle of the cutter required for different diameters and numbers of teeth. This table should

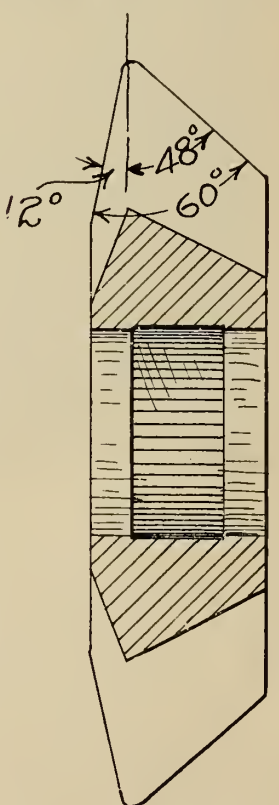

Fig. 12.

prove interesting, as it is the first time that an attempt has been made to place

the information in suitable form for reference.

All single angle cutters are set so that the straight side (9) is directly over the

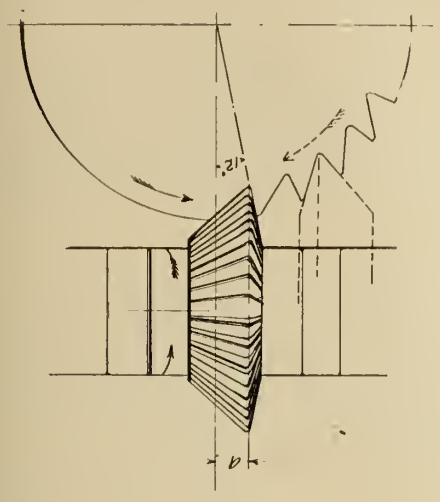

Fig. 13.

centre of the blank, so that this side produces the radial face of the tooth. Double angle cutters are set so that the sharp angle side produces this radial face, and in order that it may do so the cutter must be set off the centre of the blank an amount which is dependent on the diameter of the cutter being cut. Figure 13 shows a double angle cutter in the cut, the set-over being (a).

The setting of the cutter off centre should be done before the table of the machine is swiveled to the angle of the spiral to be cut.

In milling the teeth of spiral mills it has been found that the work should rotate against the side of the cutter which has the greater angle as shown in figure 13, where the rotation of the cutter and work is indicated by the arrows.

The figure shows a view of the work looking from the tail stock end with the direction of the feed piercing the paper. The cutter being milled is then a right-hand cutter with a right-hand spiral. If it were desired to make the spiral left-hand, then the blank would be rotated in the other direction, which in order to observe the above recommendation the cutter would have to be set in a position shown by the dotted lines. The great difficulty in observing this rule would be the increase in the size of the cutters required.

In making the divisions different methods may be employed, the method used depending on the head on which the work is being done. We have four methods in common use. These are: Direct, plain, compound and differential indexing.

Direct indexing is that method in which the index dial or plate is attached directly to the spindle, the divisions being made by detents in this plate into which a pin is dropped. In plain indexing the plate is stationary and a crank is attached to a worm shaft and the worm engaging a worm gear on the spindle. The crank carrying the index pin transmits its motion to the spindle through the worm and worm gear. The advantage of this method is that a greater number of divisions may be obtained with greater accuracy than is possible with the direct method. The

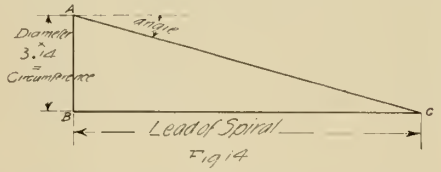

Fig. 14

compound index is a modification, or what might be called an extension, of the plain method. In this method both sides of the plate are used, using two rows of holes, one on either side of the plate, the pin engaging one side, usually the rear, of the plate being fixed and the other, the pin in the index crank. The index crank is rotated through a definite number of holes (a fraction of or any whole number of revolutions), then the crank is locked to the plate and the plate is given a movement in either direction as desired through a certain range of the holes on the rear, thus producing a compound movement of the spindle. This method has not become very common on account of its complexity. The differential method of indexing is an outcome of a desire to obtain a method by which we might divide a blank into any number of divisions, whether even or prime. This is accomplished by connecting the spindle to the index plate by a suitable train of gears and so produce the compound movement of the dial and index crank as in the compound method. The method of plain indexing answers all the requirements of the process of milling the teeth in cutters.

The spiral of all ordinary mills is given an angle of 12 degrees. This angle has been found to produce very good results and to have no excessive end thrust. Mills for milling across the edge of very thin stock may be given a much greater angle, some having as high as 30 degrees. Mills for producing very fine surfaces are also given a greater angle than would be wise on the ordinary run of work.

TABLE IV.

DATA FOR USE IN CUTTING TEETH ON CUTTERS FROM ½" TO 6" DIAMETER.

			Setover of cutter.				Change gears for spiral head.			
Diam. cutter.	No. of teeth.	Included angle of cutter used.	½" side cutting radial face.	Other side cutting radial face.	Angle of spiral.	Pitch of spiral.	Gear on worm.	1st gear on stud.	2nd gear on stud.	Gear on screw.
½	6	80°	.05"	.232"	12°	7.4	64	48	40	72
¾	8	80°	.075"	.348"	12°	11.1	64	32	40	72
1	12	70°	.10"	.424"	12°	14.83	64	24	40	72
1¼	14	70°	.13"	.53"	12°	18.54	106	48	64	72
1½	16	65°	.15"	.60"	12°	22.25	64	24	40	58
2	18	65°	.2"	.80"	12°	29.65	86	32	44	40
2½	21	60°	.25"	.88"	12°	37.05	100	24	64	72
3	24	60°	.3"	1.11"	12°	44.22	44	24	40	24
3½	26	60°	.35"	1.295"	12°	51.9	100	28	64	44
4	28	60°	.4"	1.48"	12°	59.3	100	24	40	28
5	30	60°	.5"	1.85"	12°	74.1	100	24	86	48
6	32	60°	.6"	2.22"	12°	89.0	100	24	86	40

Table IV gives the pitch of the spiral to produce approximately 12 degrees and the change gears necessary to pro-

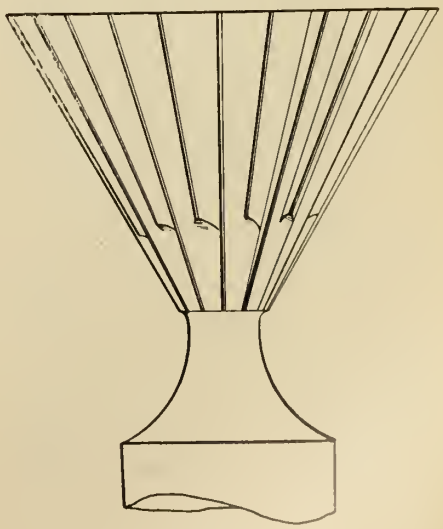

Fig. 15

duce the spiral on all standard spiral heads having a 40-tooth worm gear or

its equivalent. The lead of the spiral may be figured for any angle by the following method, figure 14: Lay out a line (A, B) equal to the circumference of the blank, which may be found by multiplying the diameter by 3.14; from one extremity (A) of this line draw at the required angle an oblique line; from the other end (B) of the line erect a line (B, C) at right angles to (A, B) intersecting the oblique line; the distance between the two intersecting points is the required lead of spiral. The angle of the spiral is always taken from the axis or centre line of the cutter blank.

In cutting the side teeth of a side-milling cutter the single angle cutter is the only style that can be used. The angle of the cutter is of a degree determined by the pitch and thickness of the siding mill, a thick mill having teeth cut much deeper than those of a thin one. When a cutter of this class cuts entirely on the side, the teeth should be made extra deep in order to have as much chip space as possible.

The method of finding the cutting angle for teeth of this kind was given in Article II, so that repetition will not be necessary. The end teeth on very small end mills are filed to shape. The same method applies also to the bevel and dove-tail cutters and small end mills. When the length of the cut on bevel and dovetail mills is of extreme length the teeth are made as in figure 15, the alternate tooth being cut out as it reaches the small end or neck of the cutter. This tooth is cut out by taking an extra trip around the cutter, setting the index to cut only half the number of teeth in the cutter or by indexing twice for each tooth cut out.

There is probably no branch of the metal-working tool business where so much is done by the "cut and try" method as in the cutter-making branch. It has until recently been in the experimental stages of their growth that other methods have not reached any point of perfection where they would prove practical. Cutter-making is essentially an experimental process at best, methods, design and material depending much on outside forces to such a degree that a standard is hard to adopt, but in any one class of work it ought to be comparatively easy to form some definite process and design to fully answer the requirements of the work in hand.

Experience will teach a great deal in this as in other branches of the machinery world, if not more. Failures, they say, are our best masters, but care must be used not to have failure master us.

Set your stake, and when you reach it, set it further ahead.

FOUNDRY SPECIALTIES.

At the recent foundrymen's convention in Cleveland, among the many useful and valuable souvenirs given away, the trick match box supplied by the E. C. Mills Oil Co., created the most interest. The firm was represented six strong and gave away during the days of the convention $1,200 worth of these souvenirs. One feature of this firm's work is the demonstrating and putting into successful and economical operation their goods in foundries throughout the country, by anyone of their fourteen traveling men, and this at their own expense.

The firm is represented in Canada by the Dominion Foundry Supply Co., with G. H. Weaver as manager, which firm have recently opened a branch office in Toronto where the interests of the firm will be looked after by Mr. Gafney.

SELLING MAGAZINE.

"Selling Magazine" is a new monthly periodical, the first number having appeared in May, 1906, published by Emerson P. Harris, Postal Telegraph building, New York. This magazine is devoted to methods of marketing machinery, tools, equipment and supplies in the most economical and satisfactory way. Articles on this subject by men of wide experience in publicity departments of large concerns and by prominent advertising agents, are published. This style of matter forms the backbone of the reading columns, and thus the paper should prove of considerable value to all interested in the selling of goods of a mechanical nature.

The cover design is attractive and the quality of the paper used is excellent. The style of make-up is two column, narrow measure. Undoubtedly this paper has an excellent future before it.

THE ILLUMINATING ENGINEER.

The Illuminating Engineer is a new monthly periodical, published by the Illuminating Engineer Publishing Co., 25 Broad street, New York, devoted to all kinds of illuminating. The cover is quite attractive and very suggestive, representing the lighting conditions of 100 years ago. The paper is of the best quality, allowing high grade printing and illustrating. The make-up is in two columns 2 1-4 inches wide.

A periodical of this kind has undoubtedly a very broad field, practically uncentered up to the present time, and thus this paper should have a good future.

PERSONAL MENTION.

The firm of Wayland Williams & Dadson, machinery dealers and manufacturers' agents, Montreal, have dissolved partnership and the business will be continued by A. T. Dadson.

* * *

Chas. G. Williams, who represents the Max Erffurt Sizing System in North America, with headquarters at Montreal, spent a part of May and June in Ontario and the Central States on a business trip.

* * *

J. A. Beattie, who has for some time been with Ross & Holgate, consulting engineers, Montreal, has left for Copper Cliff to superintend construction work there for the Dominion Engineering & Construction Co., Montreal.

* * *

Dr. Schuyler Skaats Wheeler, president of the Crocker-Wheeler Co., Ampere, N.J., sailed June 14 on the Lloyd steamship "Barbarossa," for a short European trip. He was accompanied by Prof. Francis B. Crocker, Professor of Electrical Engineering at Columbia University, who has been associated with him in business for many years.

* * *

Mr. J. C. Royce, S.B., mechanical and electrical engineer, has opened an office in Toronto. He is a graduate of the Massachusetts Institute of Technology, Boston, and has had seven years' practical experience with some of the largest manufacturing concerns in the United States, including the steel works in Pittsburg and Indianapolis, and the Baldwin Locomotive Works in Philadelphia, where he was engaged on the engineering staff for over two years. In Canada he was engaged as engineer to complete the construction and installation of the plant of the Northern Iron & Steel Co., the open hearth furnaces and gas producers being specially designed by him.

Mr. Royce has devoted considerable time to gas producer plants and the equipment of electric railway power plants. He has visited Germany and England where a very thorough experimental work upon producer gas plants has been conducted until the plants are now beyond the experimental stage. He is in touch with manufacturers and general conditions of the market there as well as in the United States, where he was sent quite recently to investigate some new plants. Mr. Royce's specialties are the design, supervision and construction of gas power plants, steam power plants for electric lighting, factories and railroads and open hearth steel plants.

Companies Incorporated

The Rheaume Foundry Co., Limited, Montreal; capital, $45.000; purpose, to carry on a foundry business.

The Moose Jaw Machine Works Company has been organized with a capital of $50,000. They will manufacture threshing engines, gasoline engines and machinery.

A new mining company to develop the Atikokan iron mines has been formed at Duluth. Dr. McKenzie, A. Snyder, H. L. Cruso, and A. Mills, of Duluth, are at the head of it.

McLachlin Bros., Limited, Arnprior, Ont.; capital, $2,000,000; purpose, to carry on lumbering business. Directors are: J. S. Lovell Wm. Bain, Robt. Gowans, E. W. McNeill and W. F. Ralph, all of Toronto.

The Amalgamated Oil Co., of Canada, Limited, London, Ont.; capital, $1,000.-000; purpose, to bore or drill for crude oil, etc. Directors are: C. B. Keenleyside, B. V. Hole, A. Keenleyside and W. D. Edy, all of London, Ont.

The Crown Lumber Co., Limited, Ottawa; capital, $20,000; purpose, to deal in timber and timber lands, and to erect saw mills, planing mills, etc. The directors are: T. Brethour, Jas. Thomas, W. D. Morris, R. G. Code, all of Ottawa.

Morse Hardware & Lumber Co., Limited, Swan River, Man.; capital, $100,000; purpose, to carry on a general lumber, manufacturing and contracting business. Directors are: H. V. Morse, J. T. Douglas, and S. G. Sanford, all of Swan River.

The Dashwood Planing Mill Co., Limited, Dashwood, Ont.; capital, $30,-000; purpose, to conduct a general planing mill and wood working business. Directors are: R. S. Hamilton, Geo. Kellermann, Geo. Koch, E. Otterbbine and J. Kellermann.

Canada Spool & Bobbin Co., Limited, Walkerton, Ont.; capital, $30,000; purpose, to manufacture and deal in spools, bobbins, wood turning, etc. Directors are: W. M. Shaw, J. W. Harcourt, J. H. Scott and T. E. Attwood, all of Walkerton, and J. R. Shaw, of Toronto.

The Jenkins Automatic Fender Co., Toronto; capital, $50,000; purpose, to manufacture and sell electric railway attachments and appliances, including the Jenkins automatic fender. Directors are: John Hallam, B. B. Jenkins, J. H. M. Jenkins, J. P. White and S. Hallam.

The Ontario Iron & Steel Company has been incorporated under Ontario charter with a share capital of $500,000 for the purpose of manufacturing, smelting and dealing in iron, steel and other metals. The provisional directors are David Muhlfelder, Joseph L. Steefel and W. M. German, with head office at Toronto.

The Geo. Long Co., Limited, Sherbrooke, Que.; capital, $90,000; purpose, to carry on the business of contractors and builders, furniture manufacturers and lumber dealers, etc. Directors are: Geo. Long, T. Long, M. V. Long, J. H. Bryce and Wm. Morris, all of Sherbrooke.

The Rainy River Navigation Co., Limited, Kenora, Ont.; capital, $40,000; purpose, to carry on general steamship business and to build steam boats. Directors are: G. A. Graham, J. T. Horne, Fort William; W. Ross, Kenora, Ont.; J. C. Graham, Winnipeg; A. R. Bartlet, Windsor.

The Empire Mfg. Co., Limited, London; capital, $100,000; purpose, to manufacture and sell metal goods, including plumbers', steamfitters' and engineers' supplies. Directors are: T. A. Stevens, Geo. Trundell, Geo. Reed, C. H. Ivey, J. C. Duffield, W. M. Gartshore and John Dromgole, all of London.

The Canadian Wire Screen Manufacturing Company has been incorporated under Ontario charter with a capital stock of $250,000 for the purpose of manufacturing wire roller window screens. The provisional directors are G. B. Meadows, H. G. Hopkirk, F. A. Mansell, M. C. Mowry and A. T. Blackwell, with head office at Toronto.

The Dominion District Steam Heating Company has been incorporated under Ontario charter with a capital stock of $100,000 for the purpose of manufacturing lighting and heating apparatus and appliances. The provisional directors are W. E. Warburton, W. Seccombe, G. E. Bradshaw, H. L. Dunn and J. W. McDonald, with head office at Toronto.

W. E. Dillon Company have been incorporated under Ontario charter with a share capital of $40,000 for the purpose of manufacturing and dealing in sheet metal goods, heating and fireproofing appliances. The provisional directors are W. E. Dillon, Daniel Batiste and Thomas Frampton, with head office at Toronto.

The Superior Portland Cement Railway Company has been incorporated under Ontario charter with a share capital of $50,000 for the purpose of constructing an electric railroad from their works to an adjoining lake. The provisional directors are George McIntyre, D. B. Brown, G. E. Brown, W. H. Jackson and W. DeL. Wilson, with head office at Orangeville, Ont.

The Electric Heaters have been incorporated under Dominion charter with a capital stock of $100,000 for the purpose of manufacturing and dealing in apparatus for use in generating heat and light. The provisional directors are A. F. Leggatt, W. L. P. Smith, C. H. Stapeldon, C. L. Bishop and A. A. Sears, with chief place of business at Ottawa.

The Toronto & Belleville Rolling Mills have been incorporated under Dominion charter with a capital stock of $599,900 for the purpose of taking over the interests of the Iron & Steel Co. of Canada and carrying on the manufacture of iron and steel. The provisional directors are W. D. Morris, Henry Nicholson, G. E. Barber, R. G. Code and E. F. Burritt, with chief place of business at Belleville.

The Morse Hardware & Lumber Co. have been incorporated under Dominion charter with a capital stock of $100,000, for the purpose of conducting a wholesale and retail hardware and lumber business. The provisional directors are H. V. Morse, J. T. Douglass, Elise Morse, Martha Ellen Douglass and S. G. Sanford, with chief place of business at Swan River.

The Great Lakes Portland Cement Company have been chartered to manufacture cement at Port Colborne, Ont. The capitalization is $1,000,000 and the promoters claim it will be the largest cement industry in Canada. Work will soon be begun on a plant that will have an output of 1,500 barrels a day, which is three hundred barrels in excess of the largest cement industry at present in operation in Canada.

Monteith-Nixon is the name of a company incorporated under Ontario charter with a share capital of $50,000 for the purpose of manufacturing and dealing in windmills, wind-engines, pumps, tanks, etc. The provisional directors are F. W. Monteith, R. B. Nixon, W. S. Monteith, Mary Maud Monteith and Winifred S. Nixon, with head office at Toronto.

The Klondike Water Supply Co., Dawson, Yukon Territory; capital, $6,000,-000; purpose, to install a system of works to convey water from the Klondike River to the different mining districts in order that mining may be carried on by the hydraulic methods. The directors are: A. McDonald, Wm. Barrett, A. B. Palmer, Dawson; R. Kelly, Vancouver; and A. E. Hitchcock, London, Eng.

Another Central Heating Plant.

A row of flats are to be built in Toronto by E. E. Sheppard to affect the old Mexican Mission House style. The buildings will be plain and simple in outline, being built of granolithic concrete. The internal design and plan of rooms are also simple, and economical of space and material, there being no partitions between the rooms in each flat, which will be merely curtained off as were the rooms in the old Mexican dwellings.

The lighting, heating and other arrangements are similar to those in other apartment houses, all coming from a central plant.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

A mica factory will be erected at Hull, Que.

George Green will build a sawmill at Carleton, N.B.

Rosthern, Sask., will install an acetylene gas plant.

The Dominion Bridge Co. will erect a plant at Winnipeg.

J. A. Humble will build a saw mill at Cross Creek, N.B.

Richmond, Que., will expend $25,000 on a waterworks plant.

Saskatoon has purchased four acres for a power plant site.

The Canada Furniture Co., Walkerton, will enlarge their premises.

Ottawa will spend $100,000 in extending its waterworks system.

The Smart Bag Company, of Montreal, will erect a $50,000 factory.

C. W. N. Kennedy, of Winnipeg, will build a $75,000 business block.

The McLaughlin Carriage Works will build a warehouse at Calgary.

W. H. Gardiner is equipping a sash and door factory at Edmonton.

Elora ratepayers carried a by-law to lend $3,500 to a furniture concern.

The Dominion Textile Company will build a $50,000 factory at Montreal.

The Peterborough Show Case Company will erect a new factory in that city.

The Saskatchewan Government will erect a $200,000 steel bridge at Battleford.

The British-American Brewing Co. are erecting a bottling works at Essex, Ont.

The Alberta Pacific Elevator Co. will erect a 500,000 bushel elevator at Calgary.

J. P. Hall, of Willow City, N.D., will establish a soap factory at Saskatoon, Sask.

The Berlin Robe and Clothing Co. will build a three-story addition to their factory.

Port Hope electors will vote on borrowing $7,400 for a lighting system on July 4.

Middlesex County Council will build a new bridge at Sylvan, Ont., to cost $10,000.

A knitting factory is proposed for Ingersoll, Ont. $10,000 will be expended.

The zinc smelter at Frank, B.C., will be in operation soon. Thos. Jones is manager.

The Canada Leather Co., at Verdun, Que., was damaged by fire to the extent of $3,000.

Chatham ratepayers will vote on the loaning of $75,000 to the Keystone Sugar Co.

W. A. Preston, of Fort Frances, Ont., and others, will build a pulp mill at that town.

The Ham & Nott Manufacturing Co., Brantford, will make large extensions to their plant.

The average daily output of the Dominian Coal Company's mines is now 14,000 tons.

Barrie ratepayers carried a by-law to vote $27,000 to enlarge their water-power plant.

Plans have been prepared for the Edmonton legislative buildings. They will cost $400,000.

The Glengarry Mills Company, of Alexandria, will build an elevator and chopping mill.

The Ottawa Furnace & Foundry Company's plant is being offered for sale by the liquidators.

Kingston ratepayers carried their by-law to raise $85,000 to improve their lighting system.

A company known as the Jackson Visible Typewriter Co. will establish a plant at Hamilton.

The Fowlers' Canadian Co., Hamilton, will increase their factory premises by a $10,000 addition.

Quance Bros., Delhi, Ont., ask for tenders for a concrete dam and power house at that place.

The Minister of the Interior has ordered an investigation of the iron ore resources of Canada.

The Canadian White Company, of Montreal, have the contract for Walker's new theatre, Winnipeg.

The Chapman Ball-Bearing Co. have purchased land on Sorauran ave., Toronto, for a new plant.

The Quatsino Power & Pulp Co. will erect a $200,000 pulp mill on the north end of Vancouver Island.

The Canada Flax & Fibre Co., of Montreal, will build a flax mill and elevator at Milestone, Sask.

The Canada Carriage Co. will erect a three-storey addition to their works at Brockville, to cost $20,000.

The Brandon, Saskatchewan & Hudson Bay Railway will build a new station at Brandon to cost $30,000.

The Western Systems Company has been organized to manufacture loose leaf systems, office books, etc.

The Brantford Screw Works have decided to remain in that city and will erect a large plant on a new site.

Telford & Co., bankers, of Owen Sound, have sold their business to the Sovereign Bank of Canada.

E. F. Hutchings, of Winnipeg, and others will establish a harness factory at Portage la Prairie, Man.

Victoria, B.C., fire department is considering a proposal to equip its fire engines with electric motors.

The Jones Co., manufacturers of office fittings. Toronto, purpose starting a branch factory in Winnipeg.

The Yale Columbia Lumber Company had their works at Nakusp, B.C., destroyed by fire. Loss $22,000.

The Brandon Machine Works Company will build an office and wareroom building at Brandon to cost $16,000.

The earnings of the Lake Superior Corporation for the year ending June 30 next will amount to $5,200,000.

Fort William ratepayers have approved a by-law to raise $125,000 to bring water from Loch Lamond.

British Columbia lead production during 1905 amounted to over fifty-six million pounds, valued at $1,971,818.

A. J. Mulvey, of Stillwater, Minn., is at the head of a company who will build sawmills near the G.T.P. terminus.

The Ontario Iron and Steel Co. have concluded the purchase of 60 acres of land at Welland for their new plant.

The International Electric Company have asked Chatham for a loan of $20,000 to establish a new plant there.

The Gillies hotel syndicate have decided to build a hotel and theatre building in Vancouver, costing $300,000.

J. P. McArthur, of Winnipeg, has formed a million dollar company to engage in railway contracting business.

The Adams Wagon Works, of Brantford, will increase their factory and plant to handle increasing business.

The Hamilton Plate & Mirror Glass Company will go into the manufacture of plate glass and mirrors in Hamilton.

The Automatic Telephone Company will erect a factory at Brantford for the manufacture of telephone supplies.

The Ogilvie Flour Mills Co., will erect a million bushel elevator at Fort William as soon as the old one has been removed.

The Smart Bag Co. are building a factory 125 x 75 feet on Mullins street, Montreal. The structure will cost $50,000.

E. Cowper Thwaite, of London, Eng., has purchased the Mallery mineral claims on Howe Sound, B.C., for $250,000.

The Canadian Mine & Smelter Supply Company intend establishing a plant in Victoria to manufacture mining machinery.

The Berg Manufacturing Company contemplate manufacturing sand lime bricks and machines for making same in Brantford.

The Norton System Telephone Company are negotiating with Peterborough with a view to establishing a factory there.

The commercial travelers of Manitoba have joined the Dakota and Minnesota

travelers in convention at Albert Lea, Minn.

The Pacific Coal Co. has ordered two 150 h.p. boilers from the Robb Engineering Co. for their mine at Bankhead, Alberta.

The London Cement Brick Machine Manufacturing Co. will build a large brick factory to accommodate their works.

Halifax men have purchased the Dartmouth Electric Light, Heat & Power Company, and will extend and improve its service.

The Dominion Steel Co. and the Soo Company are said to have enough orders on hand to keep them going for two years.

The Northern Iron Works, Winnipeg, have purchased 25 acres in the suburbs of that city upon which they will erect a new plant.

The Bank of Ottawa, Parry Sound, offers for sale 67 square miles of timber limit on the Georgian Bay with a new mill upon it.

The Canadian Westinghouse Electric Co. have the contract for machinery for lighting the new Traders' Bank building, Toronto.

Sir Thomas Shaughnessy has announced that Windsor Station, Montreal, will be increased to four times its present capacity.

Electricity, which has in many cases been a source of profit to the mines of the Canadian west, is being utilized still more extensively.

The Malleable Iron Company, of Amherst, N.S., will commence building their new plant at once. It will be of brick, 300 by 75 feet.

The Grand River & Western Power Co., of Brantford, are seeking incorporation with a view to generate power from the Grand River.

G. W. Archibald & Co., Winnipeg, have the contract for the mill for the Maple Leaf Milling Co., at Kenora, Ont. The price is $200,000.

The Bachus-Brooks Co., Minneapolis, have purchased the limits of the Keewatin Lumber Co. in Northern Ontario and will erect large mills.

The Logan Tanning Co. are improving the steam plant at their tannery, Pictou, N.S., and will install a 150 h.p. Robb-Armstrong Corliss engine.

The Dominion Steel Co. received $674,800 in bounties last year. The Algoma Steel Co. received $404,900 and the Nova Scotia Steel Co., $125,768.

The Ontario Public Works Department calls for tenders for additions to the chemical building and the greenhouses at Guelph Agricultural College.

The Western Iron Works have opened up a new factory at Elmwood, Winnipeg, for the manufacture of ornamental and architectural iron work.

George Townsend, of Chicago, has the contract for building the Hamilton, Ancaster & Brantford Electric Railway. Work will be commenced shortly.

In a 24-hour run the rail mill at the "Soo" has just turned out 859 tons, a few tons above the record run recently made by the Dominion Steel Co.

The United States Steel Co., which it is understood purposes erecting a million dollar plant near Sandwich, Ont., have paid over $17,000 cash for the land.

The Dominion Textile Co., Montreal, have taken out a permit to build a seven-storey factory, at a cost of $50,000, on St. Ambroise street, Ste. Cunegonde.

The Ontario Iron & Steel Company are making preparations for the erection of their new plant at Welland, and have a large quantity of material on the ground.

A meeting of the directors of the Dominion Iron and Steel Co. has been called for June 6th, when, it is understood, reorganization plans will be discussed.

The Canadian Westinghouse Co. have just completed the largest generator manufactured in Canada. It is for the British Columbia Electric Railway Co. of Vancouver.

The Diamond Flint Glass Company are about ready to commence work. About twenty tons of composition will be treated daily, with an output of 1,200 dozen bottles.

N. J. Holden & Co., Canadian sales agents for the Chicago Pneumatic Tool Co., have moved their Toronto office from the Temple Building to 42 York street, Toronto.

Woodstock council and board of trade sent a committee to Detroit to examine an iron working industry that desires establishing a Canadian branch. They reported favorably.

The coal and steel companies of Cape Breton are suffering from a scarcity of labor and their output threatens to be materially reduced this year if conditions are not improved.

American capitalists have been negotiating with Hamilton for some time with a view to establishing a carpet factory there, and it is said arrangements are completed.

Port Elgin will instal a waterworks system at a cost of $30,000, and have guaranteed a loan of $10,000 to Stephens, Hepner & Co. for additions to their brush factory.

The Canadian McVicar Engine Co. will establish a plant in Galt to make gas and gasoline engines. A. W. Wright, president of the American Abel Co., is president of this company.

The Canadian Westinghouse Co. have secured a contract to supply the Montreal Street Railway Co. with equipment to cost $130,000. Fifty sets of air brakes are included in the order.

Fredricton, N.B., council have about decided to purchase a boiler from Robb Co., of Amherst, and a hundred horsepower engine from Goldie & McCulloch, of Galt, for their lighting plant.

The Canadian Pacific Railway Co. have ordered one thousand additional box-cars from the Angus shops. Contracts on box-cars now under way in these shops aggregate $2,000,000.

The Central Foundry Co. will commence at once to fit up buildings in Port Hope for their new plant. They will install machinery to the cost of $75,000, and employ 25 men the first year.

B. W. Snow, the Chicago crop expert, says Canadian crop conditions were never more perfect than at the present time. The increase in the entire Canadian wheat acreage is 10 per cent.

Preparations are being made to start the Belleville rolling mills. Cars of scrap and sortings are on the way. The new company will be known as the Toronto & Belleville Rolling Mills Co.

The Consolidated Electric Co., Limited, 710 Yonge street, Toronto, are installing a number of the King Edward motors in the press room of the Murray Printing Co., Jordan street, Toronto.

The Canadian Fairbanks Co., Montreal, have been awarded the contract for a Fairbanks-Morse 21 h.p. suction gas producing plant, being installed by the W. H. Comstock Co., Brockville, Ont.

The Montreal Street Railway Co. have recently installed a new 1,000 k.w. Westinghouse generator, three 500 k.w. Westinghouse motor-generator sets, and 50 sets of the Westinghouse air brakes for new cars.

The Ontario Government has accepted J. R. Booth's tender for a pulpwood area near Montreal River. He pays a bonus of $300,000, and 40 cents a cord for spruce cut, and 20 cents a cord for all other woods.

The Brown Alaska Mining Co., Vancouver, B.C., have just received from the Jenckes Machine Co., Sherbrooke, Que., a 100 h.p. tubular boiler, the order for same having been placed with the Vancouver office of the company.

The by-law to give the Canadian Iron & Foundry Company a $20,000 site for the car wheel works was carried at Fort William and work will be commenced at once on a plant that will produce 75 tons of finished product a day.

The Canadian Metal Company's smelter at Frank, Alta., has been completed and is now producing and shipping zinc. This is the first smelter of its class in the Dominion and it should prove to be a great boon to the Canadian market.

The "Model Library," sold by Spon & Chamberlin, New York, consisting of four 25c. books—Electricity, Dry Batteries, Electrical Gas Lighting, and Woodwork Joints—has proven to be very popular in Canada and the United States.

The Rush Bay Golden Horn Mining Co., Rat Portage, Ont., recently purchased from Allis-Chalmers-Bullock, Limited, Montreal, a mining plant, including a Huntington mill, two Overstrom concentrators, and the accessory machinery.

Excavation work has begun on the site for the new Guarantee Company of North America building on St. James street, Montreal. C. E. Deakin is the general contractor, and the fireproofing

will be done by the Roebling Construction Co. of Buffalo.

A Glace Bay despatch says the Dominion Coal Company now have ten mines producing. Total shipments for the month were 330,015 tons. If sufficient labor can be procured the June output is expected to be the largest in the history of the company.

The London, Eng., Standard's New York correspondent says that the Steel Trust will not erect its proposed plant in Canada in 1906 but has options on land at Hamilton and Collingwood. This is incorrect as no such options are held by the U. S. Steel Corporation.

The output of the collieries of the Nova Scotia Steel & Coal Company for May reached a total of 59,289 tons, an increase over the corresponding month last year of 21,036 tons, and the largest in the history of the company for one month, except November, 1905.

The new machine shop of the West Allis Works extension of the Allis-Chalmers Co., which is to be devoted entirely to steam turbines, is now nearing completion, and the second installment of orders for new machine tools covers a wide range of machine tool builders in the States.

The Peterborough Cereal Co. have just installed a large gas producer plant in their works at Peterborough. In future Canada Flakes will be toasted by gas produced in the power plant of the company. This is the first producer plant to be installed in Canada to be used for this purpose.

The Blanchite Process Paint Company has been incorporated under Ontario charter with a capital stock of $250,000 for the purpose of manufacturing paints, varnishes, etc. The provisional directors are J. C. B. Blanch, O. C. Arlitz, B. M. Armstrong, J. E. Askwith and Andrew Haydon, with head office in Toronto.

The Transcontinental Railway Commission has received four tenders for 65,000 tons of steel rails. Two tenders were from the Canadian plants at Sydney and the Soo, one was American and the fourth English. It is likely the contract will be divided between the Canadians.

The Jenckes Machine Co. have recently shipped to the Alberta Portland Cement Co., Calgary, a complete hoisting plant consisting of 40 h.p. locomotive boiler and 7 x 10 hoisting engine, together with hoisting rope, steam piping, etc. The order was placed with the company's Rossland office.

The Rheaume Foundry Company have been incorporated under Dominion charter with a capital stock of $49,000, for the purpose of carrying on the business of founders in all metals. The provisional directors are Jeremie Rheaume, J. L. Rheaume, Valere Rheaume, Donatien Rheaume, and A. L. Rinfret, with chief place of business at Montreal.

The Canadian Consolidated Mines at Trail, B.C., are now using a Westinghouse electric locomotive for hauling cars to and from the mines, as well as three Westinghouse 1,250 k.w. transformers. The company find that the use of electricity for power and haulage increases the output of the mines, and actually decreases the operating expenses.

The Catholic School Board, of Montreal, have decided to purchase a lot on Haymarket square, for the purpose of erecting two schools for the parish of St. Helen. The construction of a school for boys will be undertaken at once, but the erection of the other, which is to be a girls' school, will be deferred until next Spring.

The West Kootenay Power & Light Co., Rossland, B.C., are adding to their equipment 6 step-up transformers, each of 1,875 k.w. capacity, to transform from 2,200 volts to 60,000 volts, and 6 step-down transformers each of 1,250 k.w. capacity, to transform from 60,000 volts to 2,200 and 440 volts. The consulting engineers are Ross & Holgate, Montreal.

I. Matheson & Co., Limited, New Glasgow, N.S., manufacturers of mining machinery and engines and boilers, have secured the exclusive right of manufacture in Canada of the Capell mine ventilating fan. The inventor of this fan is Mr. G. M. Capell, England, and the fan has an excellent reputation in England. I. Matheson & Co. are also getting up a splendid design of engine for direct connection to this fan.

A large Canadian syndicate has recently been formed in Mexico, the capital interested being chiefly that interested in the Mexican Light & Power Co., and has purchased the tramway service of Mexico City, and the tramway service and lighting service of City of Puebla. This syndicate is now building power houses on the Necaxa and Tenango Rivers, from where transmission lines will be run to surrounding cities and towns.

The A. R. Williams Co., Toronto, are looking for a site for a branch warehouse at Vancouver. The A. R. Williams Co. was started when Mr. Williams retired from the firm of Thompson & Williams, farm implement and threshing machine manufacturers, Stratford, Ont., and has since absorbed the Soho Machine Works, the Brantford Hollinrake Co., and the London Tool Works, besides smaller concerns.

The works of the Vancouver Fire Clay Co. at Matsqui, on the south side of the Fraser River, near Mission, have been completed so far that they will be put in operation at once. The production of fire brick, fire clay, sewer pipe, farm drain tile, etc., will be included in the enterprise. All local capital and local parties are interested in the project and as the very best quality of rock deposits has been secured in large quantities a permanent industry of great value is assured.

A Winnipeg despatch announces the turning on of the power at the Winnipeg Electric Street Railway Company's great plant on Pinnawa Channel, Winnipeg River. The plant is located 60 miles from the city, and is capable of developing 10,000 horse-power, which will be transmitted to Winnipeg for the company's street railway system, lighting, manufacturing purposes, and will enable them to practically cut their former charges in half.

Mr. Plummer's view that the Canadian market will not be able to take all the rails manufactured does not exactly agree with the more optimistic ideas held in other quarters. A man who is in close touch with steel rail conditions in Canada expressed the opinion that if the Sydney and Soo plants turned out 400,000 tons a year Canada would be able to take the whole business for at least three years to come. At the same time, if the Dominion Steel people find a foreign market it will be a good thing. The plant is in an ideal position, geographically, for export trade.

The Rossland office of the Jenckes Machine Co., Sherbrooke, Que., has closed a contract with the Dominion Copper Co., Boundary Falls, B.C., for one of their 42 x 30 Farrel Bacon ore crushers, also for a 10 x 16 crusher of the same pattern. The capacity of the larger machine is 1,500 ton to 6-inch cube in a day of ten hours, and the shipping weight is 125,000 lbs. It is the largest pattern jaw crusher so far built anywhere. Several of these crushers have been put in use by the Granby smelter, of Phoenix, within the past three years.

The Williams Gauge Co., of Pittsburg, Pa., have opened a Canadian branch office in the Temple Building, Montreal, with Wm. N. Courtenay in charge. This firm are among the pioneer manufacturers of safety feed-water regulators, steam pump governors, safety water columns, high-pressure steam traps, chain lever water gauges, rotating re-grinding gauge cocks, etc. Mr. Courtenay, who has represented the firm for a number of years in the United States, is well pleased with his prospects in this country.

Among the new buildings in Montreal on which operations have already begun are the Linton Apartment, the Montreal Light, Heat & Power Co's building, and the new Grand Trunk office building on McGill street. The latter will be a ten storey building covering nearly 10,000 square feet, and it will be constructed so that if the by-law of the City of Montreal limiting the height of buildings is altered at any time, more storeys can be added. The material to be used in the building of the structure will be a granite base with either stone or glazed terra cotta for upper storeys.

The plant of the Hall Mines Smelter at Nelson has been greatly increased and improved, and further extensions are contemplated. Recent increases in the market value of silver and lead have urged on the construction, which the growth and prosperity of the mining industry in the Nelson district has been making necessary for some time. The improvements include two additional furnaces with joint capacity for 200 tons lead ore daily; one new Heberlein roaster, now being constructed, six Heberlein convertors and an ore crusher and sampling mill. Another Heberlein roaster and six more convertors are projected. Various other improvements and additions have been made, the total expenditure on the plant being about $100,000 when construction is complete.

Among the recent orders for boilers

secured by the Jenckes Machine Co., Toronto, to be built at the St. Catharines works of the company, are the following: Three 70 h.p. 60 in. by 14 ft. high pressure, tubular boilers for Adam Clarke, Hamilton; one 60 h.p. 54 in. by 12 ft. boiler for Dominion Radiator Co., Toronto; one 40 h.p. 44 in. by 12 ft. tubular boiler for the Superior Brewing Co., Port Arthur, Ont.; one 70 h.p. 60 in. by 14 ft. high pressure tubular boiler, one 25 h.p. 42 in. x 10 ft. tubular boiler and one 50 h.p. locomotive type boiler for the Stuart Machinery Co., Limited, Winnipeg, and one 45 h.p. 48 in. by 14 ft. horizontal tubular boiler for Stevenson & Malcolm Co., Guelph, Ont.

British Columbia may look forward to the development of the pulp industry in extensive proportions shortly, the news having been received from London of the successful flotation of the company which is to take over the Quatsino Sound Pulp Co's holdings on the northwest coast of Vancouver Island. The Oriental Pulp Co., which has its limits on the mainland some distance further north, is also getting in shape for rapid construction of a mill. Both propositions are to be for making sulphite pulp. The enormous spruce timber areas of the northern coast districts of the province have long been looked on as the next source of supply for pulp, and with the extension of shipping facilities the field is opening rapidly for the disposal of the product on a large scale.

The application of electricity to mining, especially where water power is available, is recognized as a handy and economical method of operation. Among recent sales for this purpose by Allis-Chalmers-Bullock, Limited, Montreal, were a 60 h.p. induction motor to drive a two-stage centrifugal pump, and a 50 h.p. induction motor to drive a six-stage centrifugal pump, with the necessary transformers, etc., to the Dominion Copper Co., of Phoenix, B.C.; one 900 h.p., two 300 h.p., one 50 h.p., and one 25 h.p. induction motor for general work, and a 40 h.p. induction motor to drive a two-stage centrifugal pump, to the Asbestos & Asbestic Co., of Danville, Que.; and a 75 h.p. induction motor driving a compound air compressor for general power purposes, and a 115 k.w. generator for lighting purposes, to Blackburn Bros., for their mica mines at Perkins Mills, Que.

L. L. Anthes Elected.

The annual joint convention of the American Foundrymen's Association and the Associated Foundry Foremen was held at Cleveland last week. Wm. H. McFadden, of Pittsburg, was elected president of the Foundrymen's Association, and L. L. Anthes, of Toronto, one of eight vice-presidents.

New Malleable Works.

Some time ago it was announced that Smith's Falls, Ont., was to have a new malleable iron works, but later it was rumored that it was not to be carried out. However, the shops of the company known as the Rideau Malleable & Foundry Co. are to be built at once and work on the foundation is now under way, so that before the snow flies a large number of men will be employed.

Dissolution of Partnership.

A change is announced in the business of Wayland Williams & Dadson and the partnership between Wayland Williams and A. T. Dadson dissolved by mutual consent on June 15. The business will be carried on by Mr. Dadson under the firm name with the same vigor and enterprise that has hitherto characterized this company.

Promoting Chemical Industry.

All interested in the concentration or evaporation of liquors of any kind will be interested in knowing that J. A. DeCew, chemical engineer of Montreal, is the Canadian representative of George Scott & Son, of London, England, who are the largest manufacturers of vacuum evaporators in the world. The firm makes special plants for the concentration of sugar solution, caustic soda solutions, gelatine solutions, soapmakers' waste lyes, fertilizer solutions, sulphate of ammonia liquors, etc., also special plants for the refining of glycerine, crystalizing and recovery. The plants are all English made, and come into Canada under the preference of 33 per cent. Although in common use in England, they are just being introduced into Canada, and their establishment on this side will be both a development of Imperial trade and home industry. Mr. DeCew will place his laboratory and other facilities at the free disposal of his customers, in order to assist them in obtaining the best designs and plants for their requirements.

Schofield-Holden Machine Co., Limited.

R. Schofield, maker of special machinery, 14 Court street, Toronto, and A. P. Holden, 105 Adelaide street, west, have amalgamated under the name of the Schofield-Holden Machine Co. Limited. They have purchased the plant of the Canada Launch & Engine Works, Carlaw avenue, Toronto, and that business will be continued. In addition, another machine shop is under construction on Carlaw avenue, and the machines from A. P. Holden's shop on Adelaide street will be moved to the new shop. The machine shop on Court street will, however, remain as it is, and the head office will be there. All the heavy work will be done at the Carlaw avenue shops, while the light work and work wanted immediately, will be done at Court street.

The class of work done by these two men is of excellent repute, not only in Canada, but also in the United States and England; and it is to be expected that the work turned out under the new conditions will, if anything, be better than before.

The Antiquity of Iron.

Nothing is known of the origin of the smelting and forging of iron. The oldest piece of iron known to be in existence was discovered wedged between two stones in the pyramid of Cheops, which was built about 3,000 B.C. A thousand years previous to the construction of this pyramid, an Egyptian king, the oldest monarch known to history, changed the course of the Nile by erecting dams of stone. The erection of these great dams without the use of iron and steel tools, and great numbers of workmen skilled in their use, would have been impossible, so that the working of iron antedates written history many centuries.

The first great advance in the manufacture of iron was the employment of an artificial air blast to maintain and regulate the fire. Sculpture on the walls of a tomb erected at Thebes 1,500 B.C., shows that the Egyptians utilized an artificial blast. The picture shows a conical vessel suspended over a fire, which was fanned by a bellows consisting of two leather bags with a clay pipe extending down to the fire for conveying the air. Standing upon the bags, the operator pressed each alternately, closing with his heel, the hole in the top of the bag for admitting the air. When the air was exhausted, the operator removed his foot and opened the air-hole by pulling a string.

Small Tool Plant in Operation.

The manufacturing of small tools has commenced at the Bertram Works, Dundas, where in future the Pratt & Whitney tools will be manufactured for the Canadian trade. All the latest automatic and up-to-date machine tools required for fine manufacture have been installed and the plant is running in full fling. Electric motor drive has been adopted. A brighter or more completely equipped shop will not be found anywhere in this country. Work is already under way on one of the new machine shops which will form a part of the general enlargement of the Bertram works. The building is to be of steel and brick, 245 feet 6 inches long by 54 feet wide, and 45 feet 6 inches high, and will form a portion of the new erecting shop. Two cranes will be installed, one 30 ton and one 10 ton, and in this building all heavy machines like planers and boring mills will be located. A railway track will run into the building at the east end. It is the intention to further add to this plant by a machine shop and a large erecting shop. This will necessitate the employ of many more men than at present employed in the plant.

The Dominion Henderson Bearings.

The reorganization committee of the Henderson Roller Bearing Co., Limited, have about completed their work and now operations have been resumed at the plant at 875 King street west, To-

ronto, under the firm name of Dominion Henderson Bearings, Limited. The officers of the new company are:

President, Mr. Bowman, Georgetown; vice-president, W. Ogden, Toronto; sec.-treas., J. F. Adams, Toronto.

The officers of the new company saw the necessity of putting the works under entirely new management, and were fortunate in securing the services of Mr. J. Dove-Smith as general manager.

The plant installed by the old management is exceptionally well equipped and is so large as to entirely exceed the requirements of the roller bearing business and thus the company are in a position to build high-class special machinery of any kind. At present the company are negotiating for a different plant, and when they have secured a suitable place, will start the manufacture of gasoline and gas engines and gas producers, always keeping the roller bearing as their chief product. At that time they will be in the market for a few additional machines, including a boring mill, a vertical miller and an air compressor.

The new company have received some valuable testimony as to the efficiency and durability of the Henderson bearing and this has strengthened their determination to advance the bearing as their chief article of manufacture.

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Most desirable premises on King St., near Sherbourne, Toronto; close to railway siding; convenient goods entrance; three floors and basement, containing 12,103 square feet floor space.

The following tools are in good condition:

1—Power Hack Saw.
1—8 H.P. Gasoline Engine (Walwrath).
1 Bench Emery Grinder.
1 Universal " (Brown & Sharpe).
1 30 x 30" Planer (Petrie).
1—Universal Milling Machine Bertram).
1—28" Spindle Emery Stand.
1—16" Shaper (McGregor & Gourlay).
1—14" Vertical Drill Belt Drive (A. R. Williams).
1—10" Barnes Friction Speed Drill.
1—24" Vertical Drill (A. R. Williams).
1— Champion Forge.
1— Gasoline "
1— Hand Press.
1— Screw "
1— Circular Saw, Table and Iron Frame (Petrie).
1— Band Saw.
1—40" Hollow Spindle Gap Lathe (McGregor & Gourlay).
1—14" " " Engine Lathe (Porter).
1 18 x 6" Hollow Spindle Lathe No. 5 (Bertram).
1 12 x 5" Barnes Engine Lathe No. 4.
1—16 x 10" Engine Lathe (McGregor & Gourlay).
1—20 x 14" Wood-turning Lathe.

We desire to sell these premises at an early date, and are willing to make reasonable sacrifice to prompt purchaser.

Write for full particulars.

A. W. DRAPER,
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CONTENTS

Modern Canadian Manufacturing Plants 249
Plant of London Machine Tool Co., Limited, Hamilton.

Editorial 252
June's Metal Features.
Education the Basis of Progress.
The Finishing of Machine Tools.
When the Steam Engine Awakes.
Rating of Gas Engines.
Manufacturers Getting Together.

American Foundrymen's Convention 254

Antimony and its Use 256

Trade Paper Advertising 257
By Converse D. Marsh.

Chemical Action in Boiler Feed Waters 258
By J. A. DeCew, Chemical Engineer.

Tendencies in Foundry Industry... 259
By Dr. R. Moldenke.

Industrial Future of Central Canada 260
By Thos. R. Deacon.

Experiments on Strength of Cast Iron Machine Parts 262

Uses of Electricity in a Modern Factory 263

Large Increase in Iron Products.. 264

Practical Mechanics 265
Article VI. By W. H. Raeburn.

Mechanical Reviews 267
Some Pump and Engine Improvements.
Tool Makers' Vise.
A Lathe Transformed into a Turret Machine.

Tricks of Trade 269
Smart-Turner Duplex Pump.
A Selector Switch.

A Town Industrial 280

Engineering News 281
Convention of O.A.S.E.
Air Brake Convention.

Milling Cutters 282
Article III. By John Edgar.

Personal Mention 284

Companies Incorporated 285

Industrial Progress 286
Change of Speed.
Theory and Practice.
Engine Efficiencies.
Re-cutting Stripped Nut at Sea.

Practical Questions and Answers.. 270
Tapers and Taper Turning.
Gas Turbine.
Weight on Safety Valve.

Power and Transmission 272
Goldie & McCulloch Engine.
Turbine Pumps with Balanced Impellers.
Gas Plant Extensions.
The National Gas Engine.

About Catalogues 276

Machinery Development 277
Reversing Valve for Gas Furnace.
Johns Patent Beam Shears.

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BRICKMAKERS—Write us for particulars of our open air and exhaust steam dryers trucks, automatic cutting tables, disintegrators: we have the following second-hand machinery for sale, all in good repair: 1 steam power Quaker brick machine, 1 tumbling barrel for grinding bats into sand, second-hand 4x12 boiler, 16 h.p., stationary engines, slide valve. Bechtels, Waterloo, Ont. [7]

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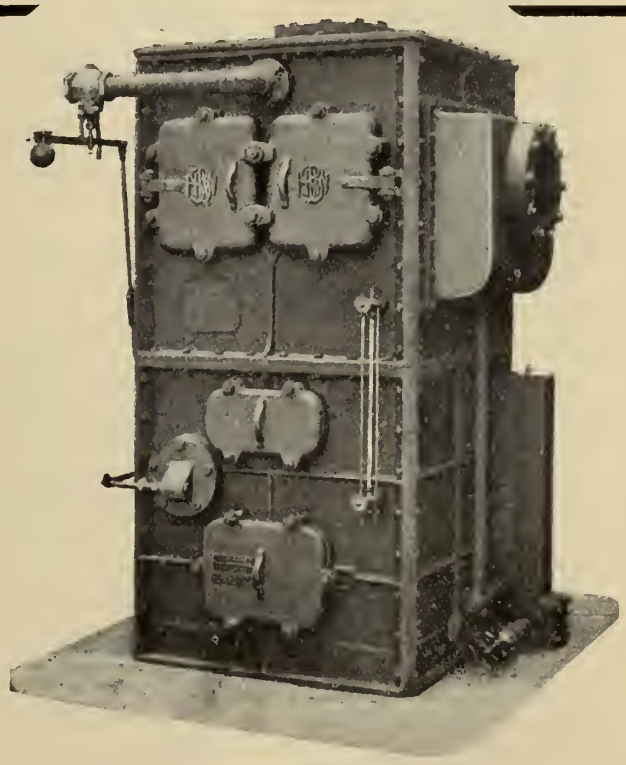

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Rice Lewis & Son, Toronto.
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London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Bolt and Nut Machinery.
John Bertram & Sons Co., Dundas, Ont.
Loudon Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co. New York.

Books, Mechanical.
Technical Pub. Co., Manchester.
The MacLean Pub. Co., Ltd., Toronto.
Spon & Chamberlain, New York

Boring and Drilling Machines.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Boring Machine, Upright.
American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bemeet-Pond Co., New York.

Boring Machines, Wood.
Chicago Pneumatic Tool Co., Chicago.
London Mach. Tool Co., Hamilton, Ont.

Boring and Turning Mills.
American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Box Puller.
A. B. Jardine & Co., Hespeler, Ont.

Brass-Washing Machinery.
Warner & Swasey Co., Cleveland O.

Brushes, Foundry and Core.
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Bulldozers.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Calipers.
Brown & Sharpe, Providence, R.I.
Rice Lewis & Son, Toronto.
L. S. Starrett & Co., Athol, Mass.
Williams & Wilson, Montreal.

Cars, Foundry.
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Castings, Grey Iron.
Dodge Mfg. Co., Toronto.
Dominion Rock Drill Co., Napanee, Ont.
Jenckes Machine Co., Sherbrooke, Ont.
Laurie Engine & Machine Co., Montreal.
R. McDougall Co., Galt, Ont.
Ottawa Steel Castings Co., Ottawa.
Smart-Turner Machine Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.
Allis-Chalmers-Bullock Ltd., Montreal.
Western Machine Co., Stouffville.

Castings, Brass.
Chadwick Bros., Hamilton.
Jenckes Machine Co., Sherbrooke, Que.
R. McDougall Co., Galt, Ont
Ottawa Steel Castings Co., Ottawa.

Castings, Semi-Steel.
Western Machine Co., Stouffville.

Castings, Steel.
Ottawa Steel Castings Co., Ottawa.

Cement Machinery.
Allis-Chalmers-Bullock Co., Montreal.
St. Lawrence Supply Co., Montreal.
Allis-Chalmers-Bullock, Ltd., Montreal.

Centreing Machines.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Centres, Milling Machine.
The Stevens Co., Galt, Ont.

Centres, Planer.
American Tool Works Co., Cincinnati.
The Stevens Co., Galt, Ont.

Centres, Shaper.
The Stevens Co., Galt, Ont.

Centrifugal Pumps.
R. McDougall Co., Galt, Ont.
D'Olier Engineering Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Centrifugal Pumps—Turbine Driven
Kerr Turbine Co., Wellsville, N.Y.

Charcoal.
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Chemicals
Canada Chemical Co., Loudon.
Economical Mfg. & Supply Co., Toronto.

Chucks, Ring Grinding.
A. B. Jardine & Co., Hespeler, Ont.
Chicago Pneumatic Tool Co., Chicago.
McLean & Sophus, Montreal.

Chucks, Drill and Lathe.
American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Ker & Goodwin, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
McLean & Sophus, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Rice Lewis & Son, Toronto.
Standard Tool Co., Cleveland.
W. T. Standish, Toronto.

Chucks, Planer.
American Tool Works Co., Cincinnati.
McLean & Sophus, Montreal.
Niles-Bement-Pond Co., New York.

Chucking Machines.
American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Circuit Breakers.
Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Clippers, Bolt.
A. B. Jardine & Co., Hespeler, Ont.

Cloth and Wool Dryers.
McEachren Heating and Ventilating Co., Galt, Ont.

Compressors, Air.
Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Canadian Westinghouse Co., Hamilton.
Chicago Pneumatic Tool Co., Chicago.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Allis-Chalmers-Bullock, Ltd., Montreal

Concentrating Plant.
Allis-Chalmers-Bullock Co., Montreal.

Concrete Mixers.
Link-Belt Eng. Co., Philadelphia.

Condensers.
Smart-Turner-Machine Co., Hamilton.
Waterous Engine Co., Brantford.

Confectioners' Machinery.
Pendrith Machinery Co., Toronto.

Consulting Engineers.
Canadian White Co., Montreal.
Charles Brandeis, Montreal.
John S. Fielding, Toronto.
Roderick J. Parke, Toronto.
T. Pringle & Son, Montreal.
James C. Royce, Toronto

Contractors.
Canadian White Co., Montreal.
D'Olier Engineering Co., New York.
Expanded Metal and Fireproofing Co., Toronto.
Laurie Engine & Machine Co., Montreal.
The Smart-Turner Mach. Co., Hamilton.

Controllers and Starters Electric Motor.
Allis-Chalmers-Bullock, Ltd., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Allis-Chalmers-Bullock Co., Montreal.
T. & H. Electric Co., Hamilton.

Conveyor Machinery
The Dodge Mfg. Co., Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Link-Belt Eng. Co., Philadelphia.
Smart-Turner Machine Co., Hamilton.
Laurie Engine & Machine Co., Montreal.
Ottawa Steel Castings Co., Ottawa.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Coping Machines.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Core Compounds.
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Core Ovens.
Hamilton Facing Mill Co., Hamilton.

Core Oven Bricks.
Hamilton Facing Mill Co., Hamilton.

Cotton Belting.
Dominion Belting Co., Hamilton

Cranes, Electric and Hand Power.
Dominion Foundry Supply Co., Montrea and Toronto.
Link-Belt Eng. Co., Philadelphia.
Niles-Bement-Pond Co., New York.
Smart-Turner-Machine Co., Hamilton.
Hamilton Facing Mill Co., Hamilton.

Crushers, Rock or Ore.
Allis-Chalmers-Bullock, Ltd., Montreal

Contractors' Plant.
Allis-Chalmers-Bullock, Ltd., Montreal..

Crank Pin Turning Machines
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Crucibles.
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Crucible Caps.
Hamilton Facing Mill Co., Hamilton.

Crushers, Rock or Ore.

Allis-Chalmers-Bullock Co., Montreal.

Cupolas.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co,, Hamilton.

Cupola Blowers.

Canadian Buffalo Forge Co., Montreal
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F Sturtevant Co., Hyde Park, Mass.
Hamilton Facing Mill Co., Hamilton.

Cutters, Coal.

Allis-Chalmers-Bullock, Ltd., Montreal.

Cut Meters

The Canadian Fairbanks Co., Montrea

Cutters, Flue

Chicago Pneumatic Tool Co., Chicago.

Cutters, Milling.

Becker, Brainard Milling Machine Co. Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.

Cutting-off Machines.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Cutting-off Tools.

Armstrong Bros. Tool Co., Chicago.
London Mach. Tool Co., Hamilton, Ont.
H. W. Petrie, Toronto.
Pratt & Whitney, Hartford, Conn.
Rice Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

Cylinder Boring Bars.

H. B. Underwood & Co., Philadelphia.

Dies, Opening.

W. H. Banfield & Sons, Toronto.
R. McDougall Co., Galt, Ont.
Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal.

W. H. Banfield & Sons, Toronto.

Dies, Threading.

W. H. Banfield & Sons, Toronto.
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Hespeler.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.

Dowel Pins.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamiltou.

Draft, Mechanical

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Man.

Draughting.

The Electric Blue Print Co., Moutreal.

Drawing Instruments.

McLean & Sophus, Montreal.
Rice Lewis & Son, Toronto.

Drawing Supplies.

The Electric Blue Print Co., Montreal

Drawn Steel, Cold.

Union Drawn Steel Co., Hamilton.

Dredges, Gold, Dipper and Hydraulic.

Allis-Chalmers-Bullock Co., Montreal.

Drilling Machines, Arch Bar.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Boiler.

American Tool Works Co., Cincinnati.
Canadian Buffalo Forge Co., Montreal.
John Bertram & Sons Co., Dundas, Ont.
Bickford Drill and Tool Co., Cincinnati.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines Connecting Rod.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Locomotive Frame.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Multiple Spindle.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Bickford Drill & Tool Co., Cincinnati.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Portable

Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
H. B. Uundrwood & Co., Philadelphia.

Drilling Machines, Radial.

American Tool Works Co , Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Bickford Tool & Drill Co., Cincinnati.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Suspension.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pood Co , New York.

Drilling Machines, Turret.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Upright.

American Tool Works Co., Cincinnati.
Canadian Buffalo Forge Co., Montreal.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co. Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
The Canadian Fairbanks Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton. Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson Montreal.

Drills, Bench.

B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Canadian Buffalo Forge Co.. Montreal.
London Mach. Tool Co., Hamilton, Ont.
W. H. Lowe & Co., Toronto.
Pratt & Whitney Co., Hartford, Conn.

Drills, Blacksmith.

Boynton & Plummer, Worcester, Mass.
Canadian Buffalo Forge Co , Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Standard Tool Co., Cleveland.

Drills, Centre.

Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
L. S. Starrett Co., Athol, Mass.

Drills, Electric.

B. F. Barnes Co,, Rockford, Ill.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drills, Gang.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Pratt & Whitney Co.. Hartford, Conn.

Drills, High Speed.

Wm. Abbott, Montreal.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.

Drills, Hand.

A. B. Jardioe & Co., Hespeler, Ont.

Drills, Horizontal.

B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drills, Jewellers.

Pendrith Machinery Co., Toronto.

Drills, Pneumatic.

Chicago Pneumatic Tool Co , Chicago.
Niles-Bement-Pond Co., New York

Drill, Radial

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drills, Ratchet.

Armstrong Bros. Tool Co , Chicago.
A. B. Jardine & Co., Hespeler,
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.

Drills, Rock.

Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Drills, Sensitive.

American Tool Works Co., Cincinnati.
B. F. Barnes Co , Rockford, Ill.
Niles-Bement-Pond Co., New York

Drills, Shop View.

John Bertram & Sons Co., Dundas, Ont.

Drills, Twist.

Chicago Pneumatic Tool Co., Chicago.
Alex. Gibb, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
New Process Twist Drill Co. Taunton, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

Drying Apparatus of all Kinds.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Out
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Dump Cars

Hamilton Facing Mill Co., Hamilton.
Jenckes Machine Co., Sherbrooke, Que
Link-Belt Eng. Co., Philadelphia.
Waterous Engine Co., Brantford.

Dust Separators.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.

Dynamos.

Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
D'Olier Engineering Co., New York.
Packard Electric Co., St. Catharines.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Dynamos—Turbine Driven.

Kerr-Turbine Co., Wellsville, N.Y.

Economizer, Fuel

McEachren Heating and Ventilating Co., Galt, Ont
B. F. Sturtevant Co., Hyde Park, Man.

Electrical Instruments.

Canadian Westinghouse Co.. Hamilton.

Electrical Supplies.

Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
London Mach. Tool Co., Hamilton, Ont.
Packard Electric Co., St. Catharines.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Electrically-Driven Tools and Machinery.

American Tool Works Co., Cincinnati.
John Bertram & Sons, Dundas.
Canada Machinery Agency, Montreal.
Canadian Westinghouse Co., Hamiltoo.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York,
H. W. Petrie, Toronto.
Pratt & Whitoey Co., Hartford, Conn.
Williams & Wilson, Montreal.

Electrical Repairs.

Canadian Westinghouse Co , Hamilton.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Emery and Emery Wheels.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Emery Wheel Dressers.

Diamond Saw & Stamping Works, Buffalo
Dominion Foundry Supply Co., Montreal and Toronto
Hamilton Facing Mill Co., Hamilton
H. W. Petrie, Toronto.
Standard Tool Co., Cleveland.

Emery Wheel Dressers. Cutters.

Diamond Saw & Stamping Works, Buffalo.

Engineers and Contractors

Canadian White Co., Moutreal.
D'Olier Engineering Co., New York.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Link-Belt Eng. Co., Philadelphia.
The Smart-Turner Mach. Co., Hamilton.

Engineers' Supplies.

Rice Lewis & Son, Toronto.

Engines, Gas and Gasoline.

The Canadian Fairbanks Co., Montreal.
Economic Heat, Light and Power Supply Co , Toronto.
The Goldie & McCulloch Co., Galt, Ont.
The Sylvester Mfg. Co., Lindsay, Ont.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.

Engines, Steam.

Allis-Chalmers-Bullock, Montreal.
D'Olier Engineering Co., New York.
The Goldie & McCulloch Co., Galt, Ont.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
John McDougall Caledonian Iron Works, Montreal.
Laurie Engine & Machine Co , Montreal.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.
Waterous Engine Works Co., Brantford.

Exhaust Heads.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Expanded Metal.

Expanded Metal and Fireproofing Co. Toronto

Expanders.

A. B. Jardine & Co., Hespeler, Ont.

Fans, Electric.

Canadian Buffalo Forge Co., Montreal.
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Fans, Exhaust.

Canadian Buffalo Forge Co., Montreal
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass

Feed Water Heaters.

The Smart-Turner Mach. Co., Hamilton.

Files and Rasps.

Rice Lewis & Son, Toronto.
Nicholson File Co., Providence, R.I.
H. W. Petrie, Toronto.

Fillet, Pattern.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton

Fire Apparatus

Waterous Engine Works Co., Brantford.

Fire Brick and Clay.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Flash Lights.

Berlin Electrical Mfg. Co., Berlin, Ont.

Flour Mill Machinery

Allis-Chalmers-Bullock Co., Montreal.
The Goldie & McCulloch Co., Galt, Ont.
Ottawa Steel Castings Co., Ottawa.

Flue Rollers.

Chicago Pneumatic Tool Co., Chicago.

Forges.

Boynton & Plummer, Worcester, Mass.
Canadian Buffalo Forge Co., Montreal.
Hamilton Facing Mill Co., Hamilton.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Forgings, Drop.

H. W. Petrie, Toronto.
St. Lawrence Supply Co., Montreal.

Forging Machinery.

John Bertram & Sons Co , Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio
Niles-Bement-Pond Co., New York.
Western Machine Co.

Founders.

R. McDougall Co., Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
Western Machine Co., Stouffville, Ont.

Friction Clutch Pulleys, etc.

The Dodge Mfg. Co., Toronto.
The Goldie & McCulloch Co., Galt, Ont.
Link-Belt Eng. Co., Philadelphia.
McLean & Sophus, Montreal.
Ottawa Steel Castings Co., Ottawa.
Sylvester Mfg. Co,, Lindsay, Ont.

Furnaces.

Dominion Foundry Supply Co , Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Gas Blowers and Exhausters

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
D'Olier Engineering Co., New York.
B. F. Sturtevant Co., Hyde Park, Man.

Gas Plants, Suction

Economic Heat, Light and Power Supply Co., Toronto.
Sylvester Mfg. Co., Lindsay, Ont.
Wayland Williams & Dadson, Montreal.
Western Machine Co., Stouffville, Ont

Gauges, Standard.

Brown & Sharpe, Providence, R.I.
McLean & Sophus, Montreal.
Pratt & Whitney Co., Hartford, Conn.

Gear Cutting Machinery.

Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cincinnati.
Brown & Sharpe, Providence, R.I.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford. Conn.
Williams & Wilson, Montreal.

Gears, Angle.

Brown & Sharpe, Providence, R.I.
Chicago Pneumatic Tool Co., Chicago.
Laurie Engine & Machine Co., Montreal.
Ottawa Steel Castings Co., Ottawa.
Waterous Engine Co., Brantford.

Gears, Reducing.

Brown & Sharpe, Providence, R.I.
Chicago Pneumatic Tool Co., Chicago.
Ottawa Steel Castings Co., Ottawa.

Generators, Electric

Allis-Chalmers-Bullock, Montreal.
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.
D'Olier Engineering Co., New York.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.

Generators, Gas.

H. W. Petrie, Torouto.

Glass Bevelling Machines.

Pendrith Machinery Co., Toronto.

Graphite.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Grinders, Bench.

W. H. Lowe & Co., Toronto.

Grinders, Centre.

Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinders, Cutter.

Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Reamer.

Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Drill.

Wilmarth & Morman, Grand Rapids, Mich.

Grinders, Tool.

Armstrong Bros. Tool Co., Chicago.
B. F. Barnes Co., Rockford, Ill.
Brown & Sharpe, Providence, R.I.
H. W. Petrie, Toronto.
The Stevens Co., Galt, Ont.
Williams & Wilson, Montreal.
Wilmarth & Morman, Grand Rapids, Mich

Grinding Machines.

Brown & Sharpe, Providence, R.I.
The Canadian Fairbanks, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Wilmarth & Morman, Grand Rapids, Mich.

Grinding and Polishing Machines.

The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Wilmarth & Morman, Grand Rapids, Mich.
Pendrith Machinery Co., Toronto.

Hack Saws.

The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
McLean & Sophus, Montreal.
H. W. Petrie, Toronto.
West Haven Mfg. Co., New Haven, Conn.
Williams & Wilson. Montreal.

Hammers, Drop.

London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Hammers, Steam.

John Bertram & Sons Co. Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co , New York.

Hangers

The Goldie & McCulloch Co., Galt, Ont.
Ottawa Steel Castings Co., Ottawa.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford.
Pendrith Machinery Co , Toronto.

Heating Apparatus.

Canadian Buffalo Forge Co., Montreal
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., High Park, Mass.

Hoisting and Conveying Machinery.

Allis-Chalmers-Bullock, Montreal.
Jenckes Machine Co., Sherbrooke, Que.
Link-Belt Eng. Co., Philadelphia.
Niles-Bement-Pond Co., New York.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford,

Hoists, Pneumatic.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co. Chicago.
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Hose, Air.

Canadian Rand Drill Co., Montreal.
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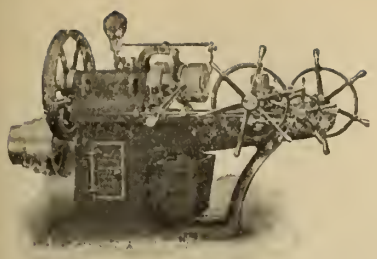

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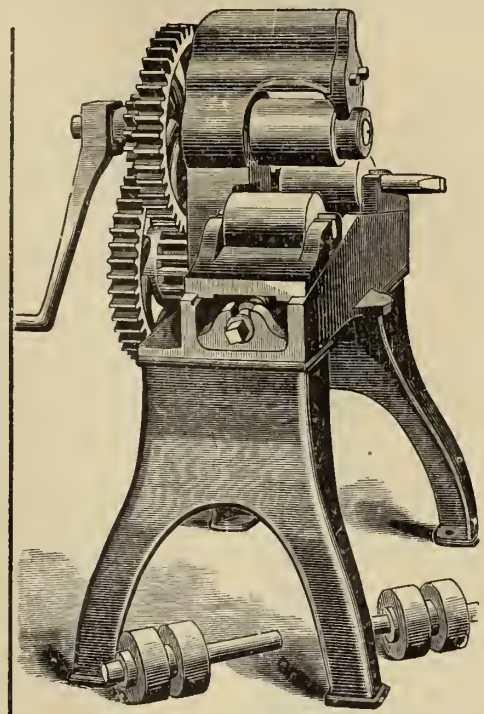

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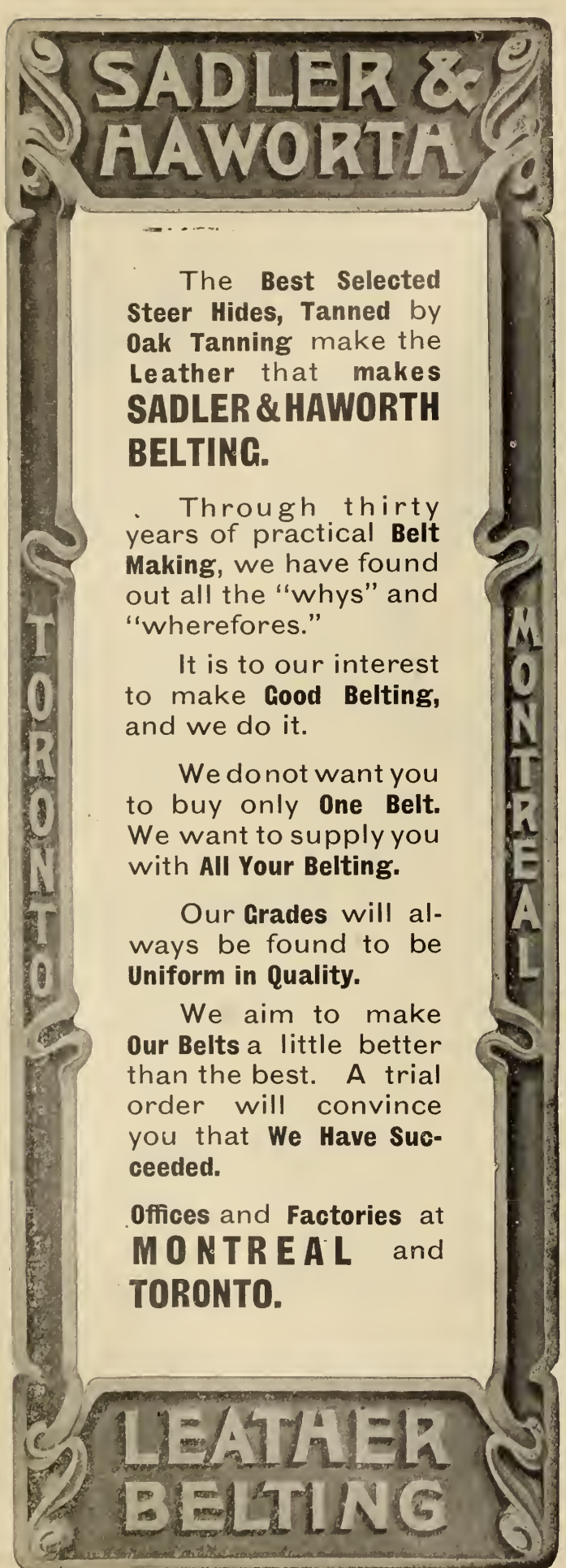
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ALPHABETICAL INDEX.

A

Abbott, Wm. 74
Allis-Chalmers-Bullock Co. ..... Outside back cover
American Tool Works Co 13
Armstrong Bros. Tool Co 72

B

Barnes, B. F., Co 72
Banfield, W. H., & Sons 10
Becker-Brainard Milling Machine Co. . 14
Berlin Electrical Mfg. Co 15
Bertram, John, & Sons ..... front cover
Bickford Drill & Tool Co 13
Boynton & Plummer 65
Brandeis, Charles 63
Brown, Boggs & Co 12
Brown & Sharpe Mfg. Co 76
Budden, Hanbury A. 63
Butterfield & Co 78

C

Canada Foundry Co. 59
Canadian Pneumatic Tool Co 78
Canada Chemical Mfg. Co 15
Canadian Buffalo Forge Co 9
Canadian Fairbanks Co 16
Canadian Rand Drill Co 73
Canadian Westinghouse Co 1
Canadian White Co 63
Carr, John 70
Chadwick Bros 70
Chapman Double Ball-Bearing Co 10
Cleveland Automatic Mach. Co 9

D

DeCew, J. A. 63
Diamond Saw and Stamping Works . .65, 71
Dillon A., & Son 70
Dodge Mfg. Co 4
Dominion Foundry Supply Co 69
D'Olier Engineering Co 69
Dominion Belting Co. 70
Dominion Sewer Pipe Co. inside back cover

E

Economical Mfg. and Supply Co 15
Economic Power, Light and Heat Supply Co 6
Electric Blue Print Co 63
"Electrical Times" 65
"Engineering" 59
Engineering Specialties Co 70
"Engineering Times" 65
Expanded Metal and Fireproofing Co. 74

F

Fetherstonhaugh & Co 63
Fetherstonhaugh & Blackmore 63
Fielding, John S. 63

G

Gibb, Alex 75
Geometric Tool Co 79
Goldie & McCulloch Co 1
Greening, B., Wire Co 68

H

Hamilton Facing Mills Co 74
Hamilton Pattern Works 70
Howard, Geo. H. 9

J

Jardine, A. B., & Co 76
Jenckes Machine Co. 15
Jessop, Wm., & Sons 74

K

Ker & Goodwin 76
Kerr Turbine Co. 5

L

Laurie Engine and Machine Co. 5
Rice Lewis, & Son 80
Link-Belt Eng. Co 6
London Machine Tool Co 14
Lowe, W. H., & Co 69

M

McDougall, R., Co 12
McDougall, John, Caledonian Iron Wks 2
McEachern Heating & Ventilating Co. 9
McLachlan Gasoline Engine Co 69
Marion & Marion 63
Merrell Mfg. Co 12
Morang & Co., Limited 59
Morrow, John, Machine Screw Co. 74

N

National Machinery Co 65
New Process Twist Drill Co 74
Nicholson File Co 73

O

Otis-Fensom Elevator Co. inside back cover
Ottawa Steel Castings Co 75

P

Packard Electric Co ..... inside back cover
Parke, Roderick J. 63
Penberthy Injector Co 65
Pendrith Mach. Co 70
Petrie, H. W 11
Potter & Johnston Machine Co 9
Pratt & Whitney Co ..... inside front cover
Pringle, T., & Son 63

R

Remington Typewriter Co 15
Ridout & Maybee 66
Robb Engineering Co 2
Royce, James C. 63

S

Sadler & Haworth 66
Sheldons Limited 8
Siegwartbeam Co 71
Smart-Turner Machine Co 68
Standard Bolt and Screw Co 74
Standard Tool Co 72
Standish, W. T. 12
Starrett, L. S., Co 77
St. Clair Bros. 65
Stevens Co. of Galt 78
St. Lawrence Supply Co 67
Sturtevant, B. F., Co 8
Spon & Chamberlain 65
Sylvester Mfg. Co 6

T

Taylor & McKenzie 10
Technical Pub. Co 80
Tees & Persse 70
Toronto and Hamilton Electric Co 73
Toronto Plate Glass Importing Co 65

U

Underwood, H. B., & Co 71
Union Drawn Steel Co 71

V

Volta Electric Repair Works 73

W

Warner & Swasey Co 3
Waterous Engine Works Co 5
Wayland Williams & Dadson 6
West Haven Mfg. Co 76
Wells Pattern & Model Works 70
Western Machine Co 75
Williams & Wilson 7
Whitman & Barnes 77

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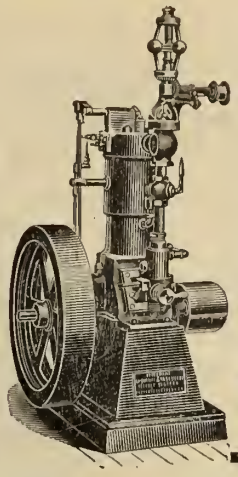

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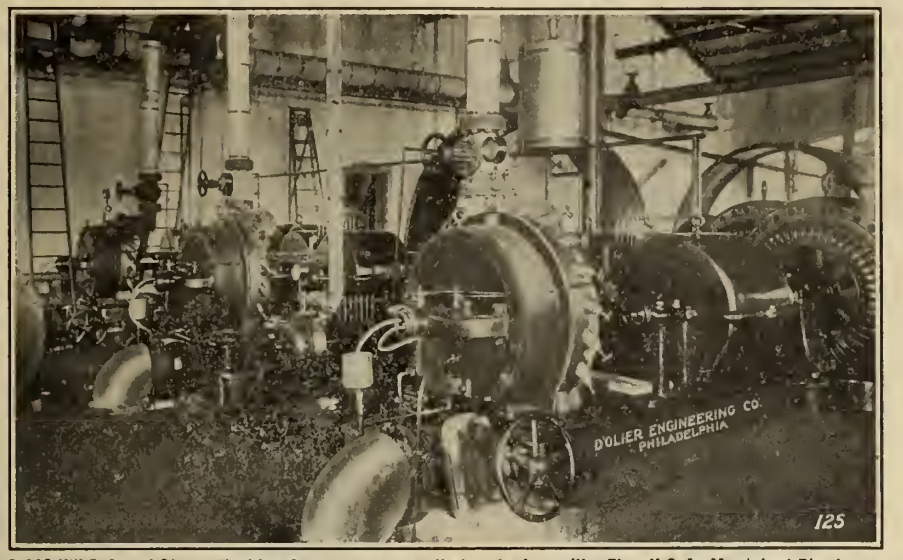

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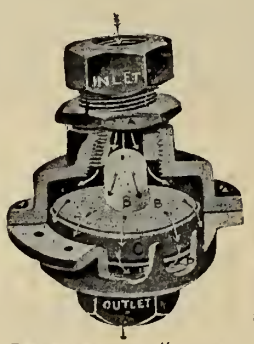

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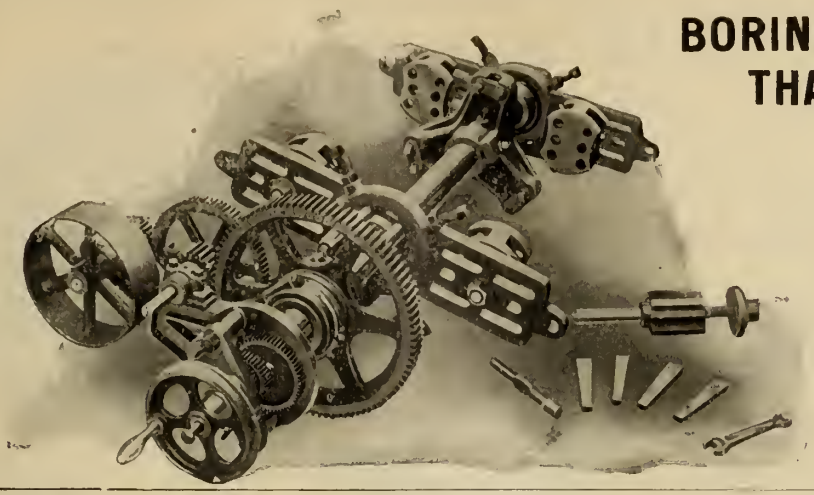

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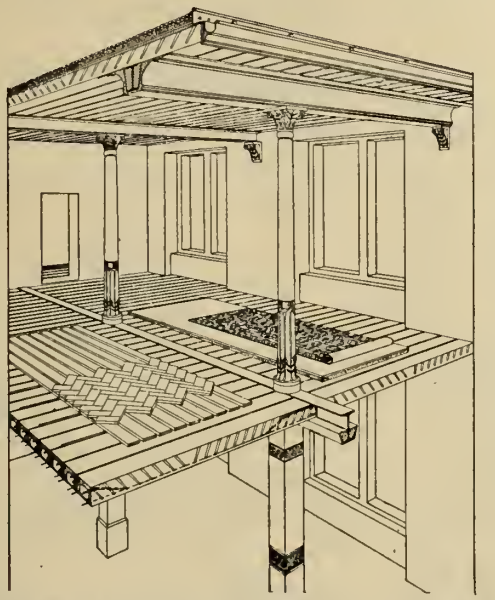

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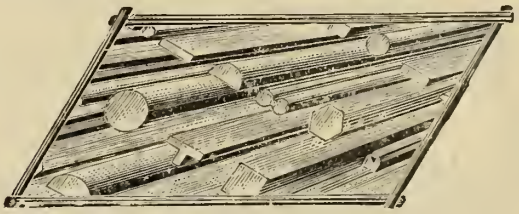

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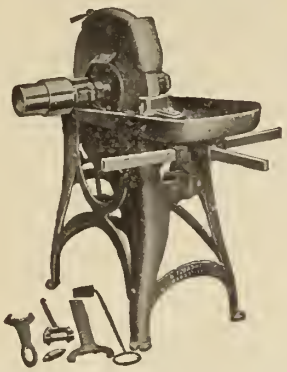

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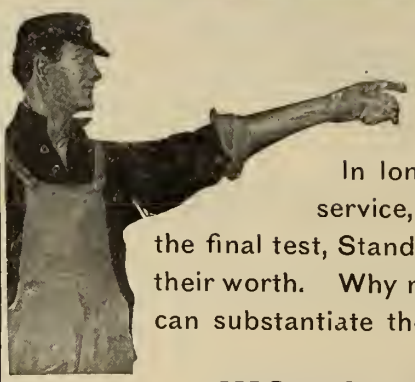

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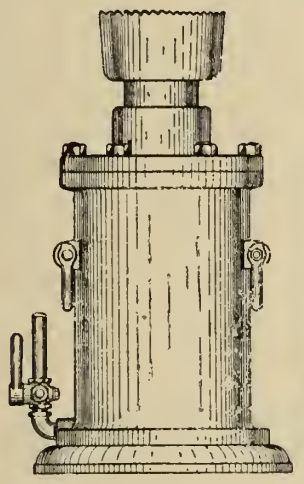

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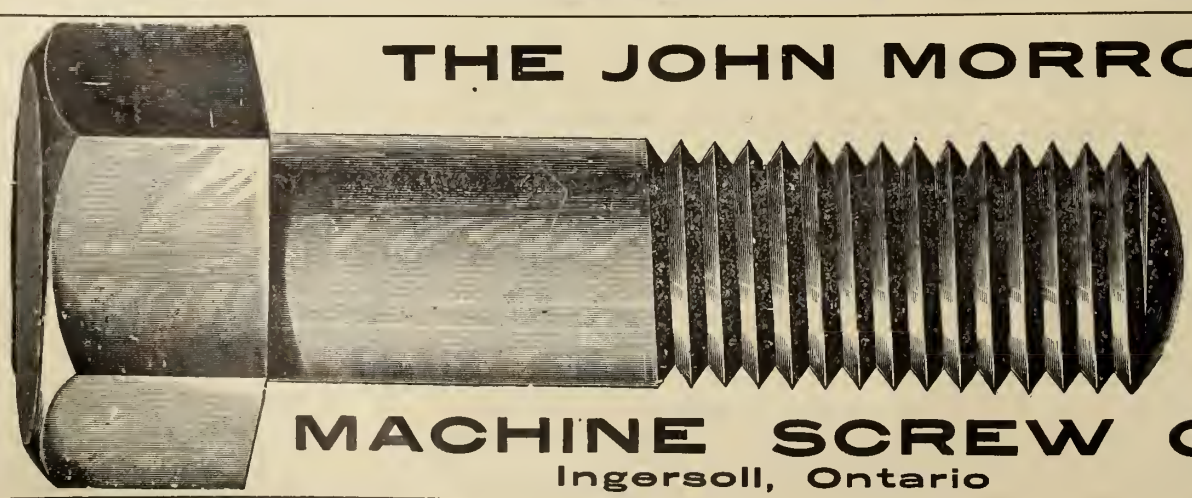

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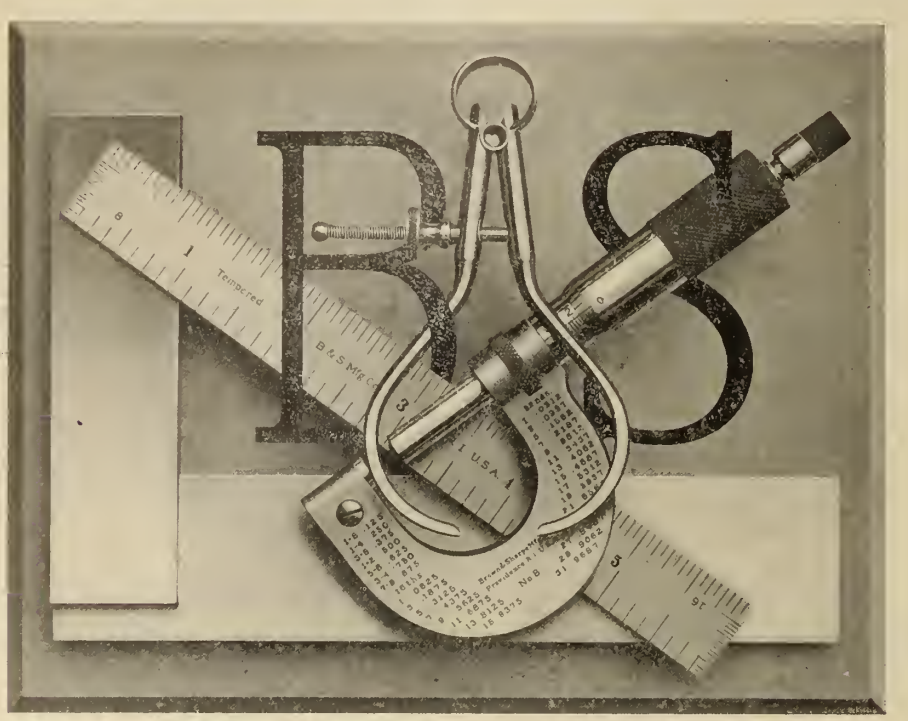

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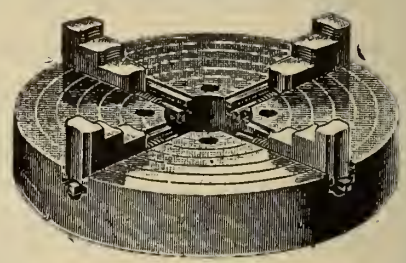

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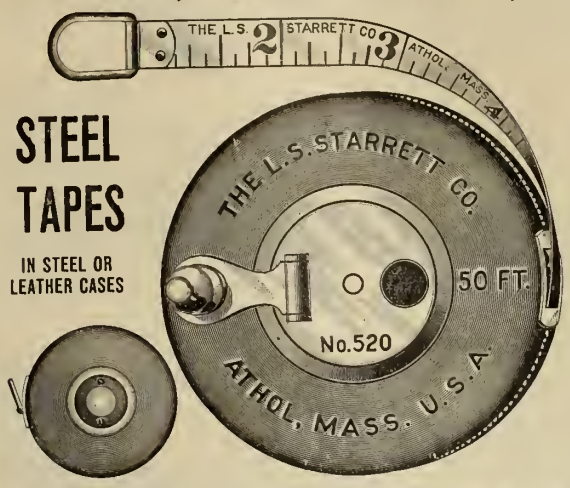

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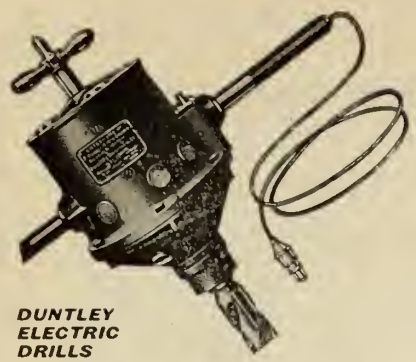

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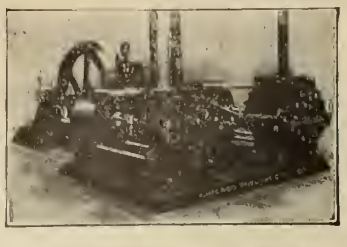

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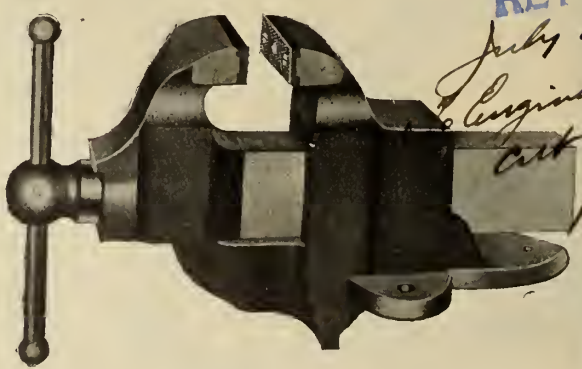

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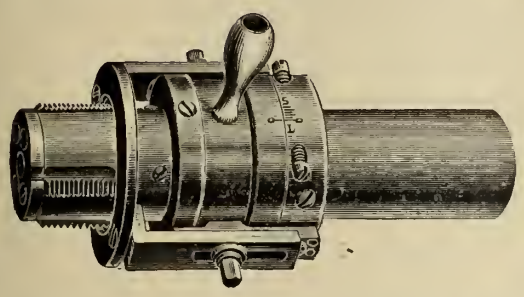

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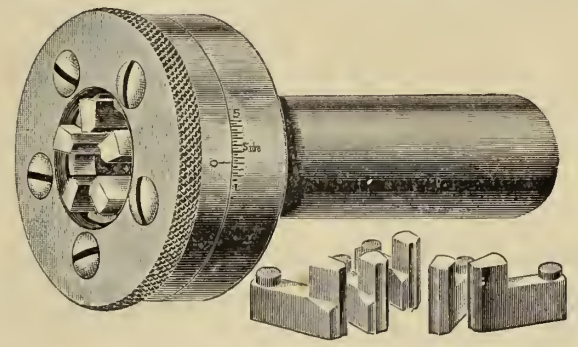

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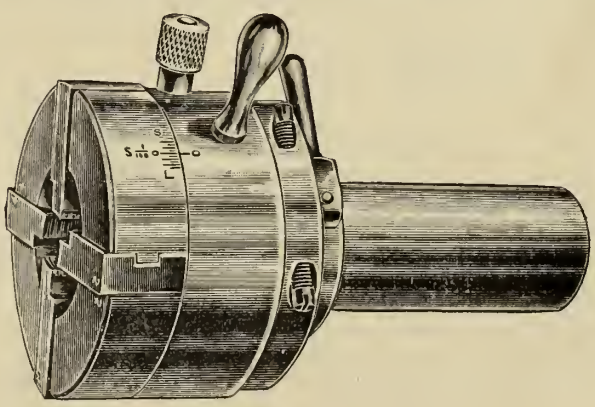

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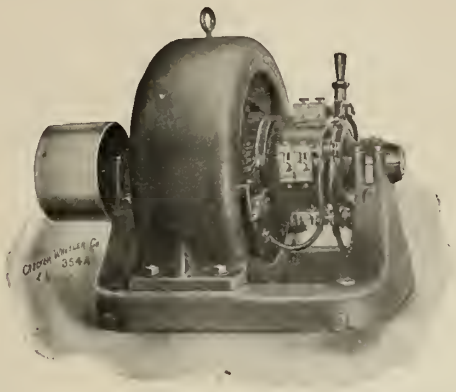

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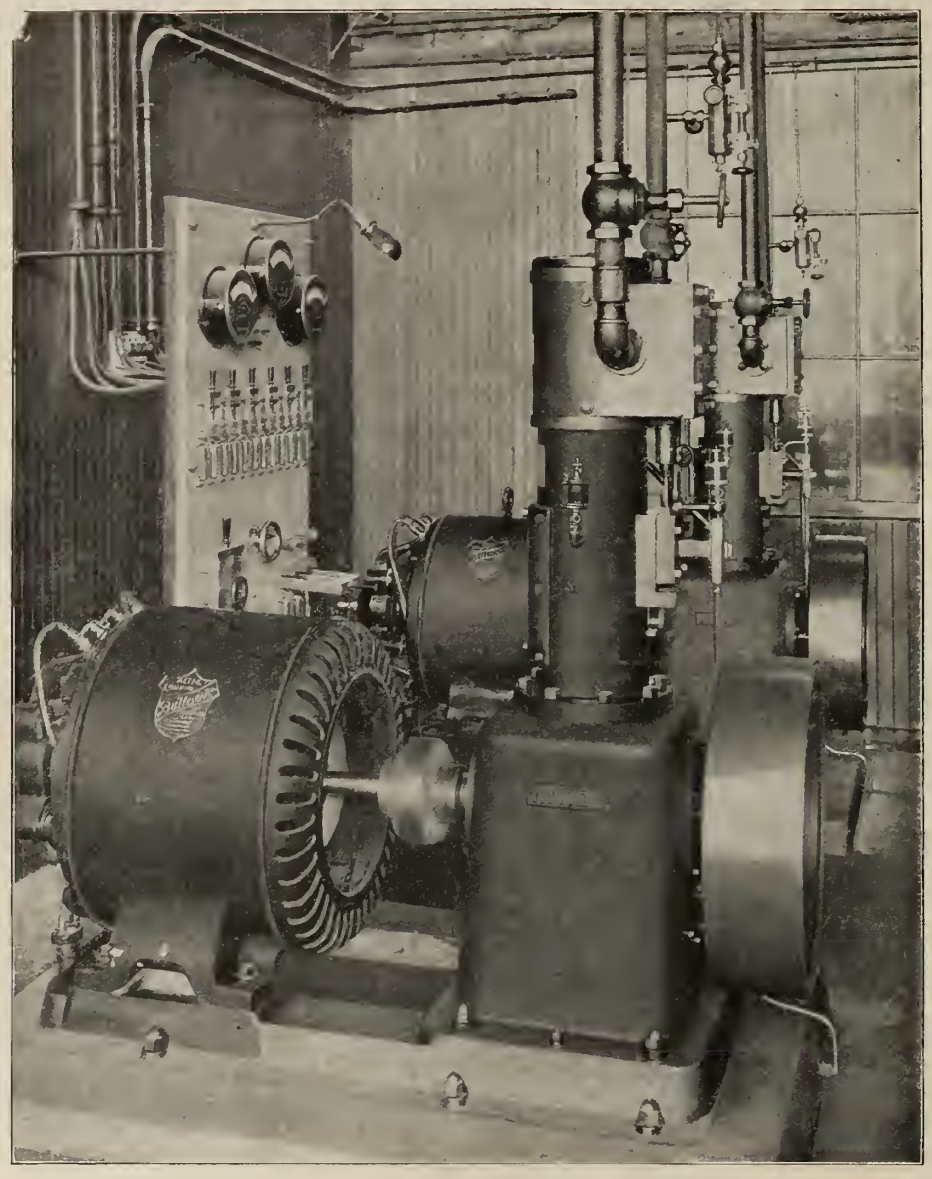

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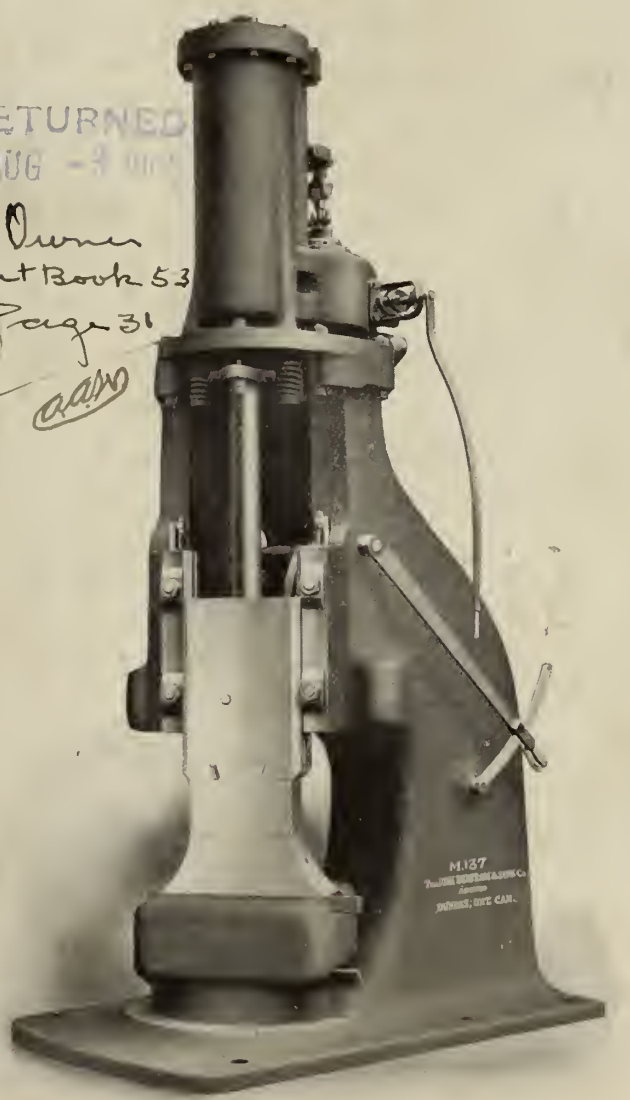

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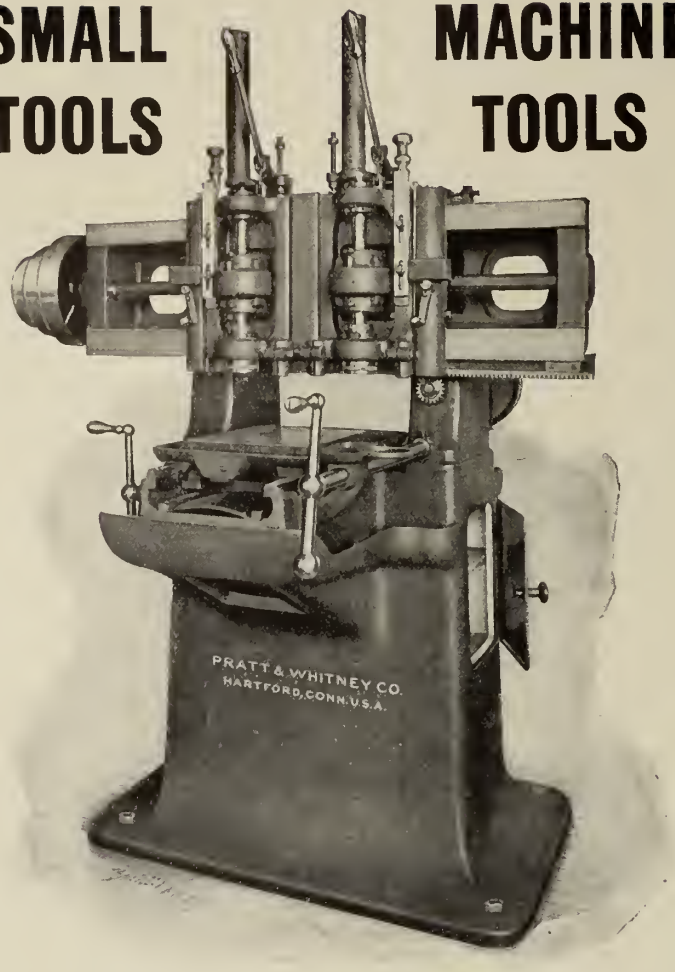

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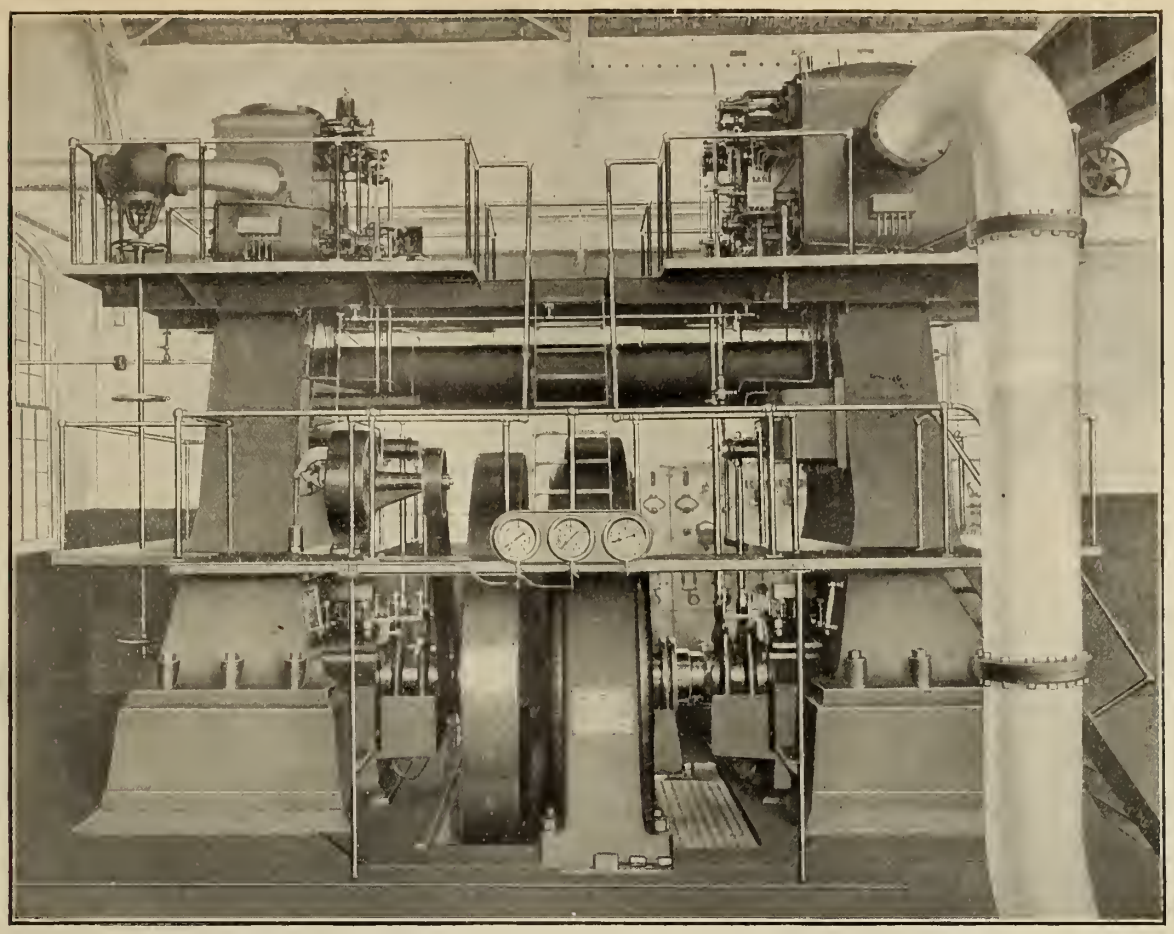

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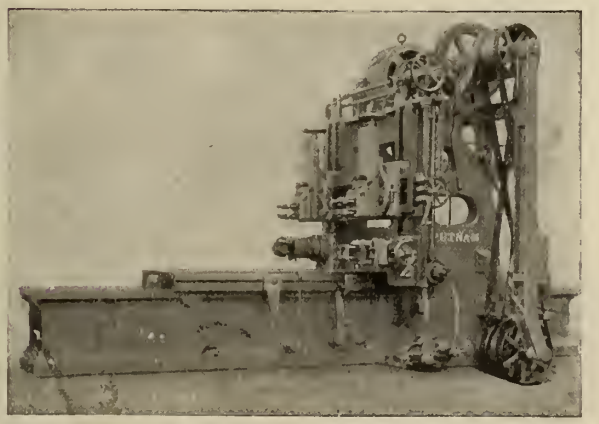
THE GOLDIE & McCULLOCH CO., LIMITED

GALT — ONTARIO — CANADA

Always Investigate "Quality"

when considering the qualifications necessary in a motor for a given class of work.



Westinghouse Type S Motor Driving Putnam Planer.

The Westinghouse Motor Qualities

which tell in machine-tool drive are:

Rigid construction—Heavy shafts—Split and interchangeable bearings, with two oil rings in each—Bearings may be removed for replacement without disturbing pulley—Shunted brush-holders and perfect brush-holder adjustment—Water-and oil-proof field coils.

Canadian Westinghouse Co., Limited

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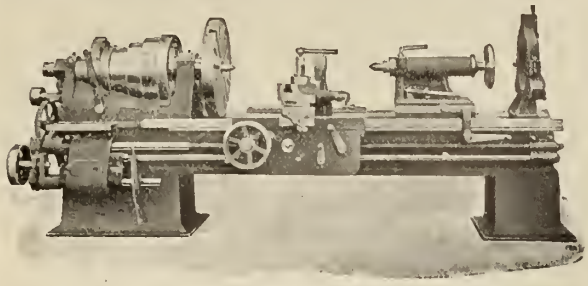
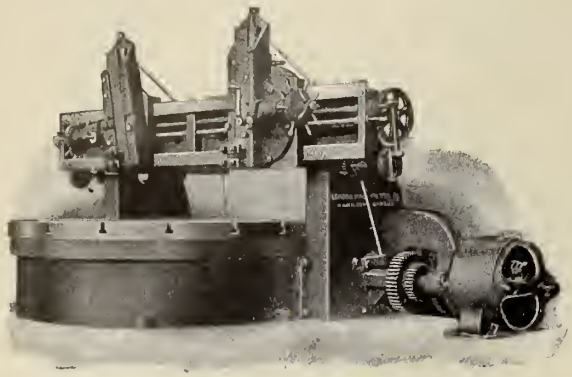
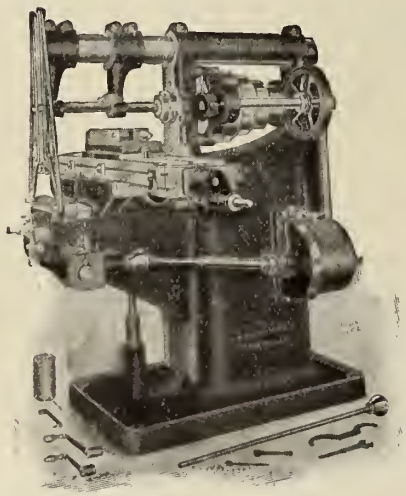


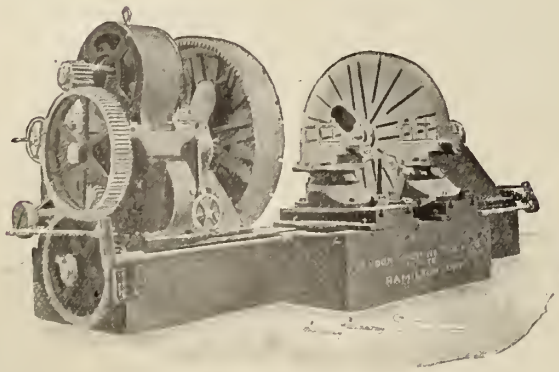
27-in. Double Back Geared Engine Lathe.



100-in. Tire Boring Mill.



No. 3 Plain Kempsmith Miller.



90-in. Driving Wheel Lathe.

HERE are illustrated several of our latest types of High Grade Machine Tools. In designing our different lines of machines every part is planned for the rapid production of accurate and reliable work. Machines are built exceptionally heavy and capable of using High Speed Steels to their maximum capacity. Our new plant at Hamilton is the most complete of its kind in Canada, and is equipped with every facility for the rapid handling of heavy and accurate work.

When in Market for Machine Tools, write

London Machine Tool Co.

LIMITED

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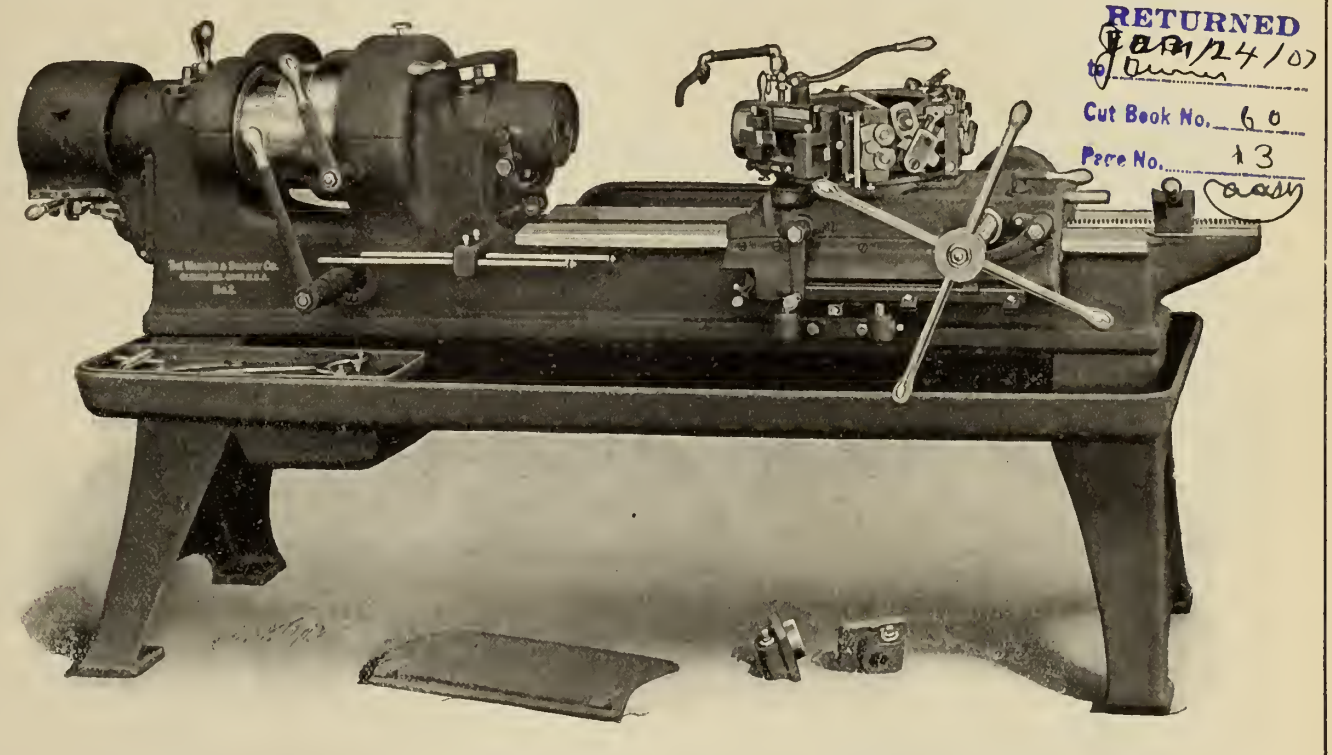
WARNER & SWASEY TURRET LATHES

In styles and sizes for all requirements—bar or chuck work. Have every modern facility for rapid—accurate—economical production.

The Interesting Particulars for the Asking.



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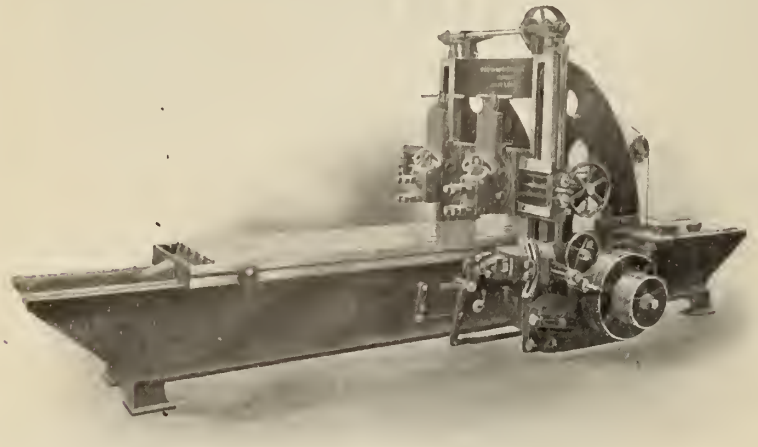
The Hollow Hexagon Turret Lathe here illustrated---adapted for any lathe work up to 3⅝ in. diam., 36 in. long. Three sizes---1½x18, 2¼x24 and 3⅝x36 inches.

The Warner & Swasey Company

CLEVELAND, OHIO, U. S. A.

Turret Lathes, Screw Machines, Brass-Working Machinery.

A Planer to do Good Work



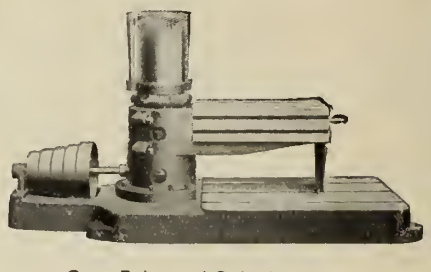
must have been built in a shop where **good work is done on Planers.** We would like you to see just how good the work comes off one of our machines and we know you will say, **"that will do me exactly."** We use the utmost care in both materials and workmanship and the result is the highest type of finished product. We are busy now, but will be pleased to take time to **"show you."**

THE R. McDOUGALL CO., Limited

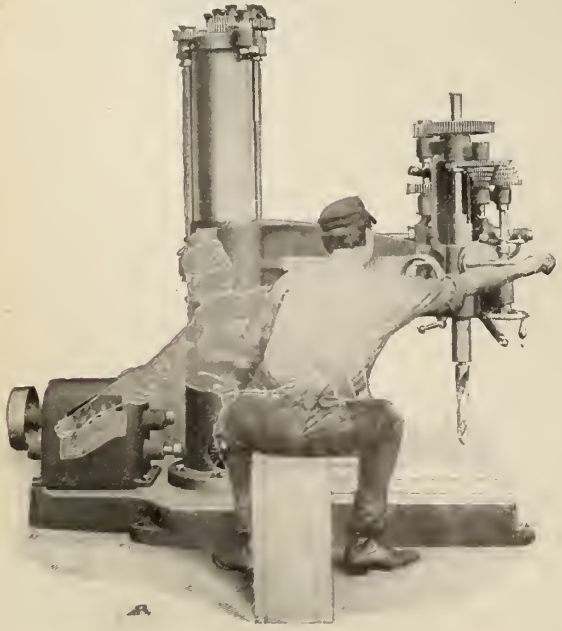
GALT, CANADA

Has Greater Productive Capacity

than any Upright ever built—our 30-in. RADIAL DRILL. Costs but a trifle more and is admirably adapted to light and medium manufacturing, being particularly effective in taking care of the ordinary work as found in the average shop.



Cone Drive and Swinging Table



Bickford 30 -36"-42" Radial Drill

A Few Features

12 speeds when driven through a speed box ; 10 when a cone is used.

Tapping attachment incorporated in the design of the head.

Fitted with any one of six styles of tables.

Circular 1-A for the asking.

The Bickford Drill & Tool Company

Cincinnati, Ohio, U.S.A.

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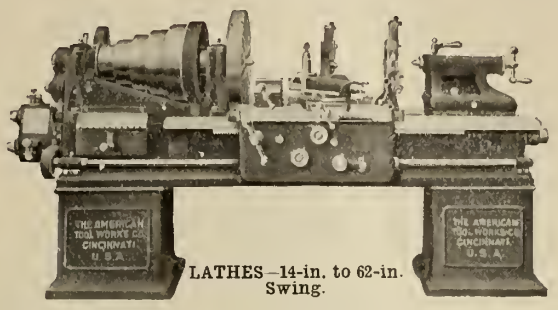
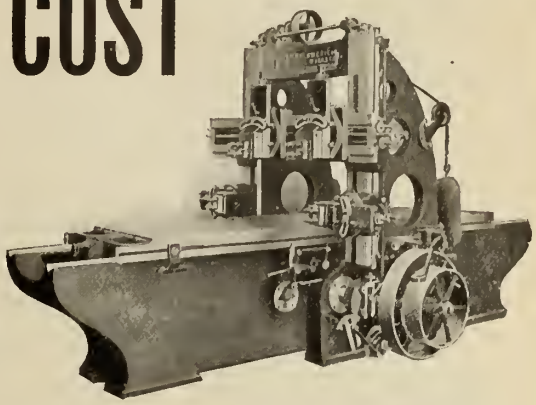
CANADIAN AGENTS—H. W. Petrie, Toronto. Williams & Wilson, Montreal.

FOR REDUCING SHOP COST



LATHES—14-in. to 62-in. Swing.



PLANERS—22-in. to 72-in. between Housings.

HAVE YOU AN "AMERICAN" IN YOUR SHOP?

IT IS A SOURCE OF GREAT SATISFACTION

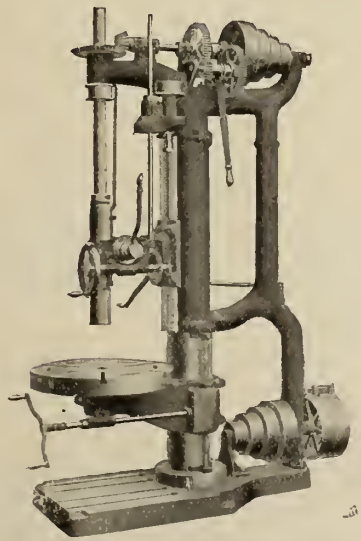
The realization that you have purchased a thoroughly sound, correctly built modern tool, that it is working to best advantage for your interests, that its amount of profits returned is greater than that of a machine of lesser merit.

PROPER DESIGN—EXACTING CARE IN CONSTRUCTION THESE ARE WHAT MAKE THE "AMERICAN" FAMOUS.

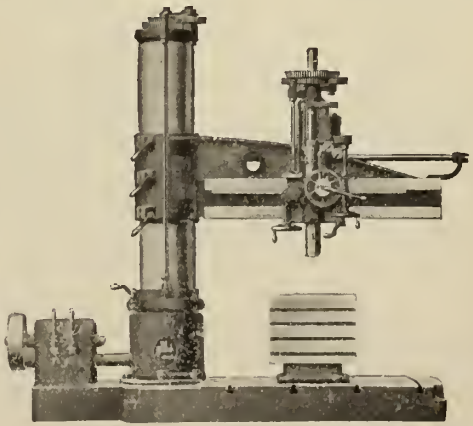
THE AMERICAN TOOL WORKS CO.

CINCINNATI, U.S.A.

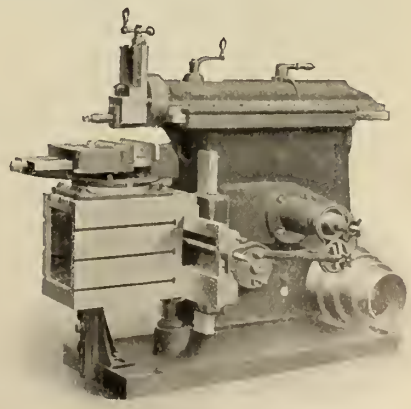
LATHES, PLANERS, SHAPERS, RADIAL DRILLS, UPRIGHT DRILLS.



UPRIGHT DRILLS—13-in. to 36-in. Swing

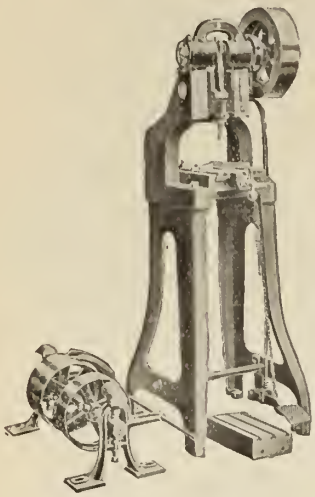


RADIAL DRILLS—2½-ft. to 7-ft. Arms.



CRANK SHAPERS 16-in. to 28-in. Stroke.

You would be Surprised



to know how useful and handy is this **KEY-SEATER.**

We can't get along without it in our shop, and if you had one in your shop, you would think so too.

It cuts small internal keyways in gears, pulleys, etc., and does the work in a most rapid and pleasing manner.

Cut shows machine complete with Pedestal, but we can furnish it in bench style if desired.

Ask for our 1906 Catalog

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B.F. BARNES DRILL AND LATHE BUILDERS COMPANY GANG DRILLS FOR RAPID WORK ROCKFORD, ILL. U.S.A.

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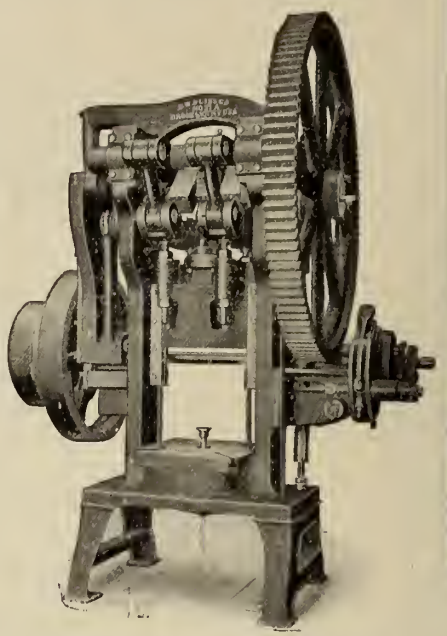
(PATENTED)

Built in sizes to cover all classes of work. They are great time savers, and are well known in both hemispheres.

The patented toggle movement insures a more perfect dwell and greatly increases smoothness of action.

Quality and prices are right.



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No. 1-14 Cutter and Reamer Grinder.

WE HAVE A FEW OF THESE MACHINES READY FOR IMMEDIATE DELIVREY

This machine is distinctly a cutter grinder, and was designed to fill the want for a machine to sharpen milling cutters of all kinds and shapes, without special fixtures or special-shape emery wheels, being heavy enough to eliminate all vibration and still be easily operated. It weighs about 1370 lbs. The table, which has a long bearing on the saddle, has a longitudinal feed of 20 in., cross adjustment of 7 in., with a vertical adjustment of 6 in. Cutters 1 in. to 14 in. can be taken between centres. The table can be used at different angles with the spindle in horizontal plane, by swiveling the knee around the column. The machine is compact, durable, adaptable and a necessity for the busy shop.

Becker-Brainard Milling Machine Co.

HYDE PARK, MASS.

CANADIAN AGENTS: A. R. WILLIAMS MACHINERY CO., LTD., TORONTO.

WHAT THE MERRELL MEANS TO YOU.

Simplicity of Construction.

Ease of Control and Operation.

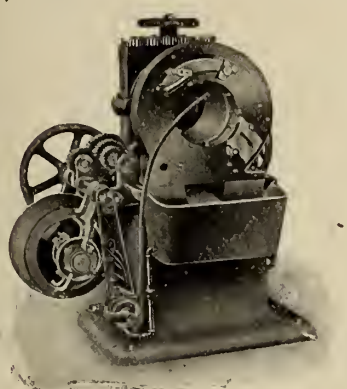
Speed in Cutting either Iron or Steel—Rough or Smooth—Pipe.

Exactness—Not a machine leaves our factory until it has passed the MERRELL test, which means not until it has undergone every test for any kind of work it could be called upon to do—is the reason why we can give you this

COMBINED HAND and POWER MERRELL

FOR FULL 30 DAYS FREE TRIAL.

We know it will do all your work in an easier, less costly and speedier manner.



This machine has great range of work. Our improved cutting-off tool cuts cleanly and quickly. Quick opening and closing die-head; encased gears; exceptionally fine steel chasers that may be released from threading while the machine is in motion.

The Head may be removed from the base and used as a portable hand machine. It will cut any size—any kind—of pipe up to 6-in.

Send a Postal for our Catalogue

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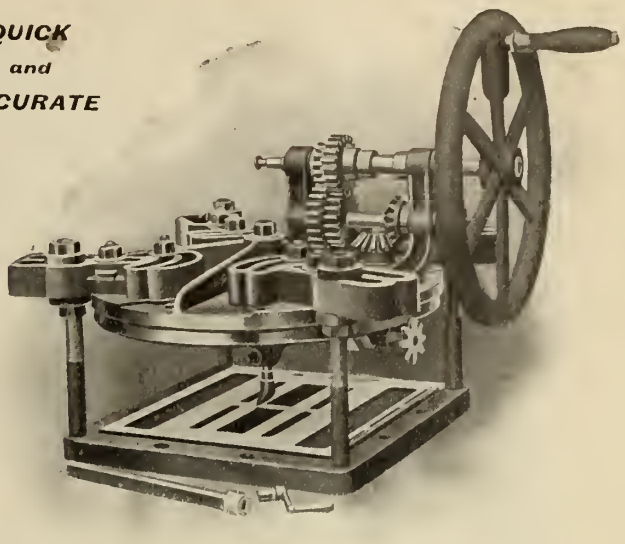

An exceedingly useful Tool to the Machinist is our

Portable Valve Seat Rotary Planing Machine

(Improved)

Designed especially to face off worn valve seats When this tool is used there is no breaking of port-edges.

Secure Catalogue

H. B. UNDERWOOD & CO.

PHILADELPHIA, PA.

BROWN & SHARPE MFG. CO.

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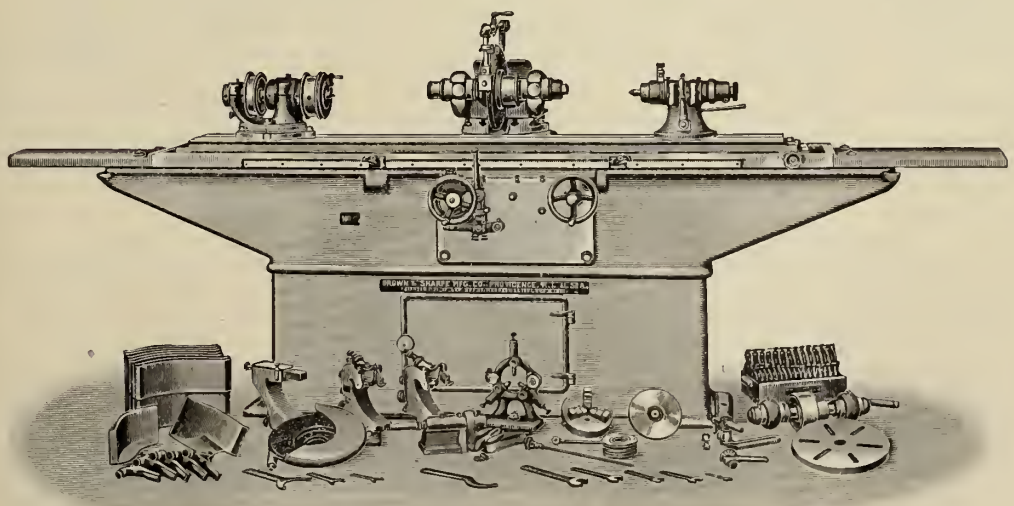
B. & S. UNIVERSAL GRINDING MACHINES



seen in the quality of the finished product.

The intelligent design insures a proper distribution of metal.

Catalogue and Circular sent upon request.

The Largest Staff.

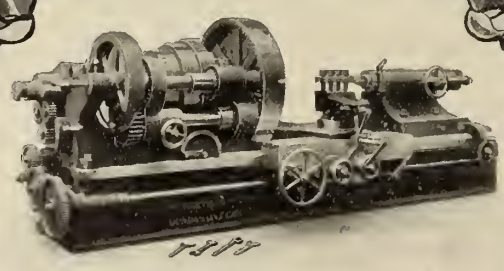
The Best Equipped Plant.

IN CANADA.

The Logic of Illustrating

The persuasive quality of advertising is practically doubled by an A1 illustration.—It impresses the possible customer with a definite idea of your product no word-picture could impart. *Vice-versa*, a poor illustration condemns your work at the outset. It's a positive sale-killer. Isn't it folly, therefore, to allow valuable space to carry a cut which is a libel on your goods? ℂ. The most extensive illustrating business in Canada has been built on the sound basis of high quality and a fair price, and—*it belongs to us.*

Draw your own conclusions



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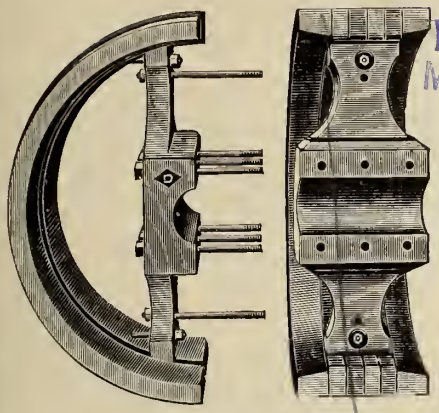
SOLD ON MERIT ONLY

Used by Power Users Everywhere



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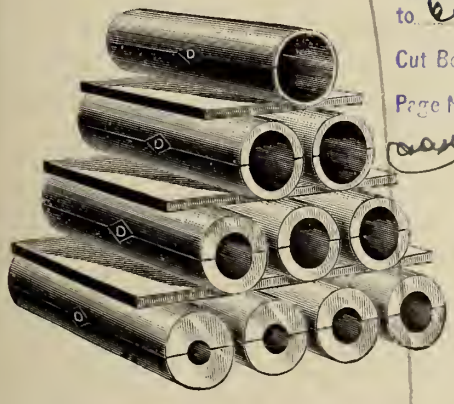

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"Real" Bushings

Note the difference between them and any other offered.

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DODGE MANUFACTURING CO.

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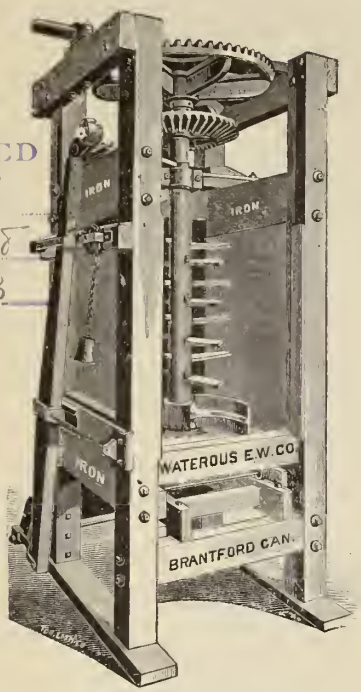
THE MARTIN STEAM POWER BRICK MACHINE



INTERIOR VIEW
Showing Gears, Tempering Knives, Wiper, Iron Rails, etc.

STYLE "B"

Weight, 8,500
Capacity, 25 to 30,000
Power, 10 H. P.

The Frame is of well-seasoned Oak, substantially built, with Iron Rails and Iron Bottom

This machine, in its original form, as built 20 years ago, has been on the Canadian market during that time, made by several parties. Not being satisfied with this old machine, we procured from the patentee the latest improved machine, and it is this machine we offer our customers. Every machine is correctly adjusted before leaving our works.

WE HAVE A FEW OF THESE MACHINES IN STOCK FOR IMMEDIATE DELIVERY

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BRANTFORD, CANADA

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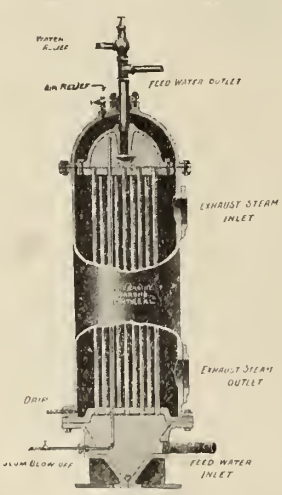

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LAURIE FEED-WATER HEATER AND PURIFIER

30 TO 2,000 HORSE POWER

LAURIE ENGINE AND MACHINE CO., LTD.

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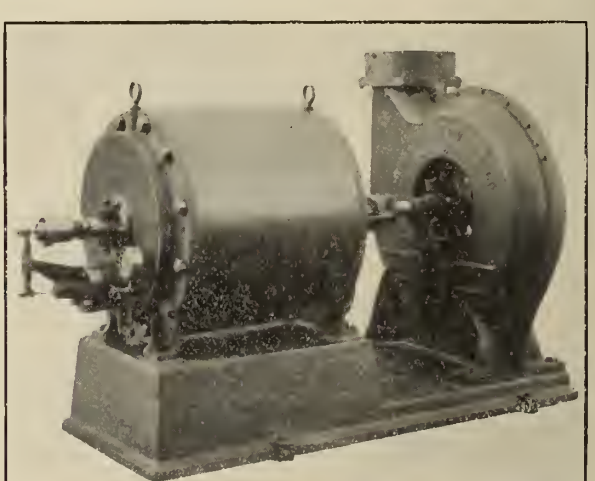

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For Gas Works, Foundries and Forge Shops

More economical than steam engines, require less attention, lubrication and space. No belts or reducing gears. Speed adjusted to pressure desired. Regulation close. Quick starting and stopping. Air pressure, 6 to 15 ounces. For any capacity.

TURBINE GENERATORS, 2 kw. to 300 kw. direct current: alternating current, 25 to 300 kw., 60 cycle. ***CENTRIFUGAL PUMPS*** for water works, condenser equipment and boiler feeding.

The illustration shows a 30 h.p. Kerr Turbine with extra heavy blower. 2850 r.p.m., 12 ounce pressure. 4150 cubic feet per minute capacity. Floor space, 28 in. by 72 in. Weight complete, 3000 lbs.

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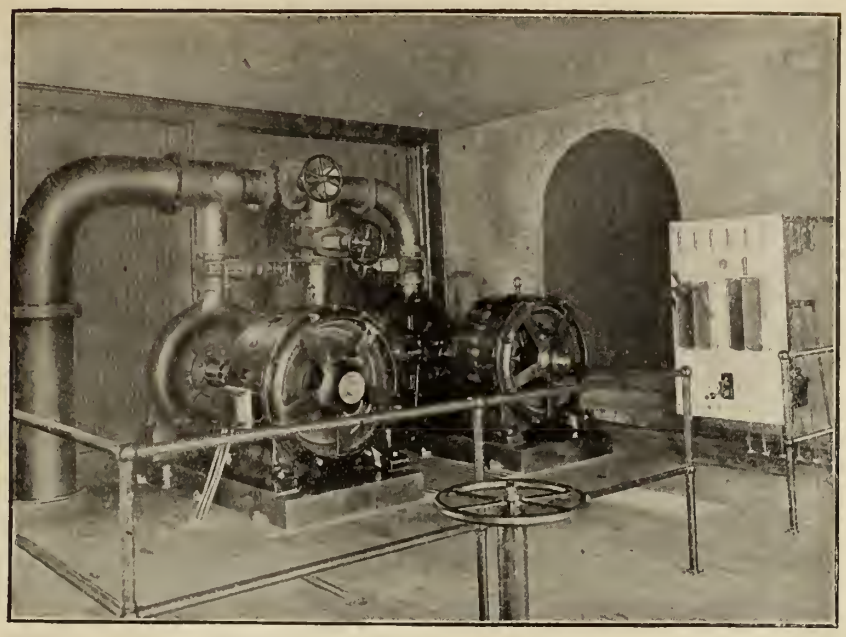
Built in Canada by

WM. STEPHENSON

34 Bay Street N. ***HAMILTON, ONT.***



Pumping Plant installed by us for Town of Lachine, P.Q.

The pumps are of the improved Worthington Turbine type, and are 8″ in diameter, working against a pressure of 160 lbs.

The John McDougall Caledonian Iron Works Co., Limited

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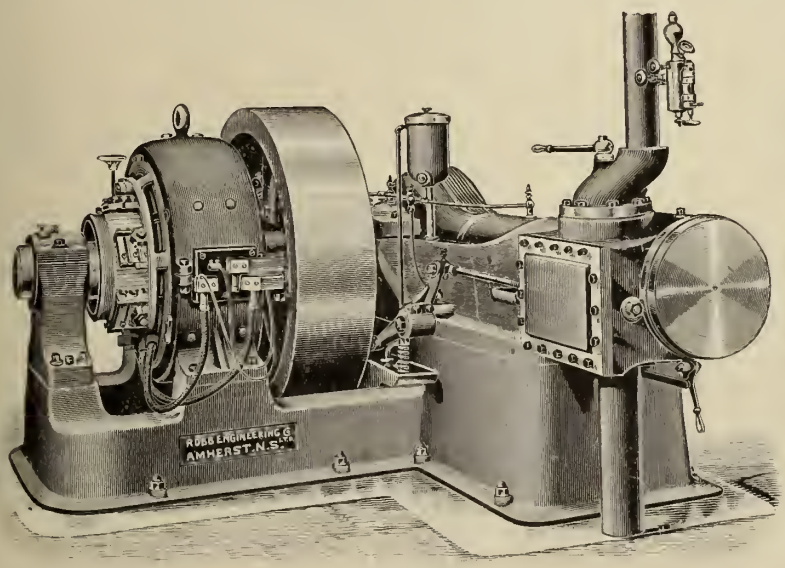
Not One Cent for Repairs!



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"After eighteen months of hard service, the 'Robb' engines are in excellent shape, running very smooth and without a bit of vibration. Up to this time they have not cost one cent for repairs, the only expense being for steam, oil and packing, and this lower than the average. Perfect alignment, parts well machined and good design, make the 'Robb' the most economical and labor-saving engine that has ever come to my notice."

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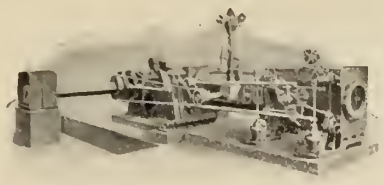
Bell Telephone Building, MONTREAL; Watson Jack, Manager.
355 Carlton Street, WINNIPEG; J. F. Porter, Manager.



Corliss Engines

Medium and heavy duty patterns

Simple and compound with the usual modifications

Write for Illustrated Bulletin.

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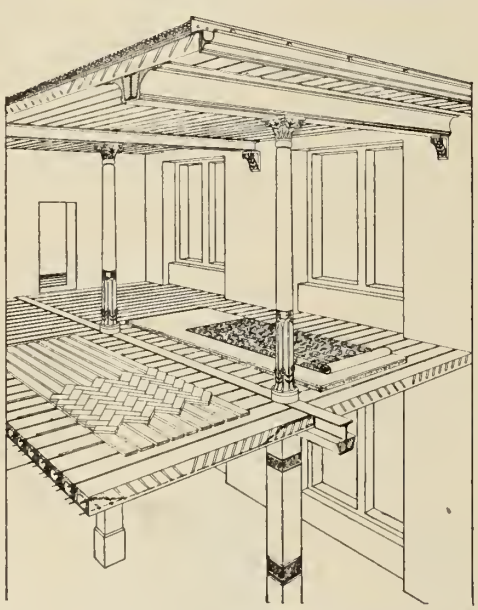
The best flooring and roofing system in reinforced concrete, cheap and easy to lay. Reform in building methods.

Saving of time. No skilled labour required. The hollow reinforced concrete beams are made to order in the factory and used hardened and dry in the building without any protection or frame work.

PATENTS IN ALL CIVILIZED COUNTRIES.

Absolutely Fireproof. Deafens Sound. Quickest and Easiest to Construct.



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30 Siegwartbeam factories in Switzerland and abroad already working. ***Patent Rights For Sale.*** For terms and further information apply to the

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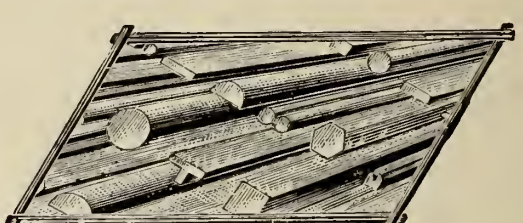
COLD DIE-ROLLED STEEL and IRON

SHAFTING

Pump Rods, Piston Rods, Roller Bearing Rods and Screw Steel.

ROUNDS, SQUARES, FLATS, HEXAGONS and SPECIAL SHAPES

True to size and highly polished.



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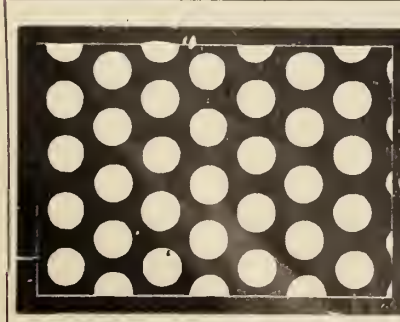

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WIRE MANUFACTURERS
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HAMILTON
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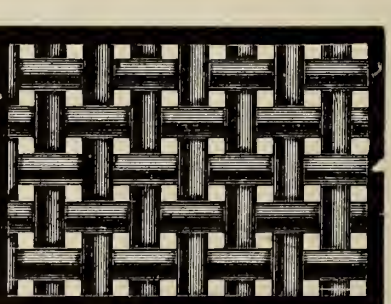

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"CANADA GRAPHITE"

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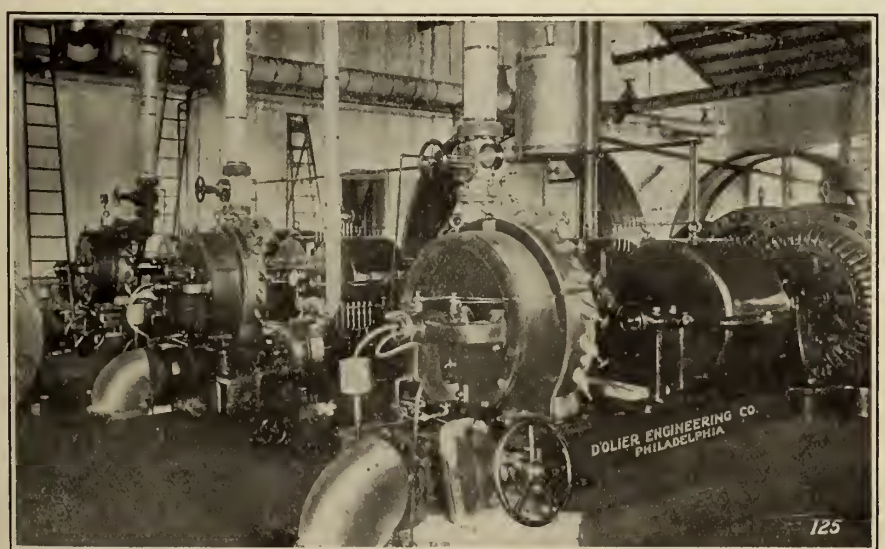

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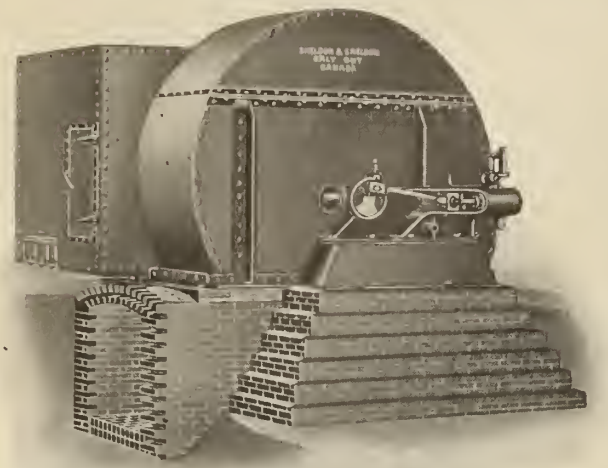

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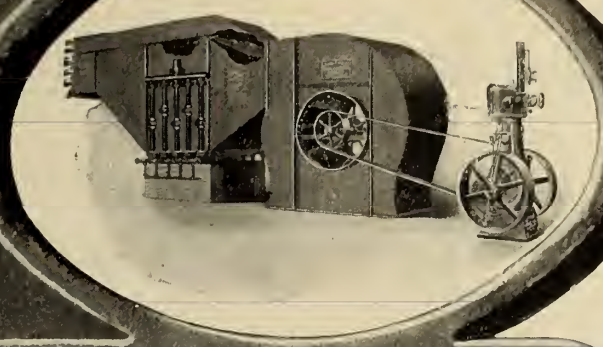

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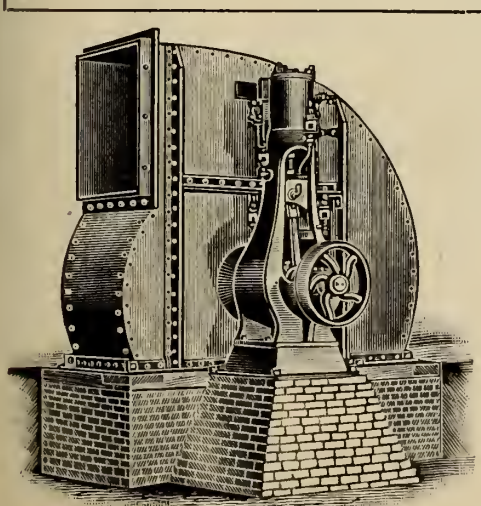

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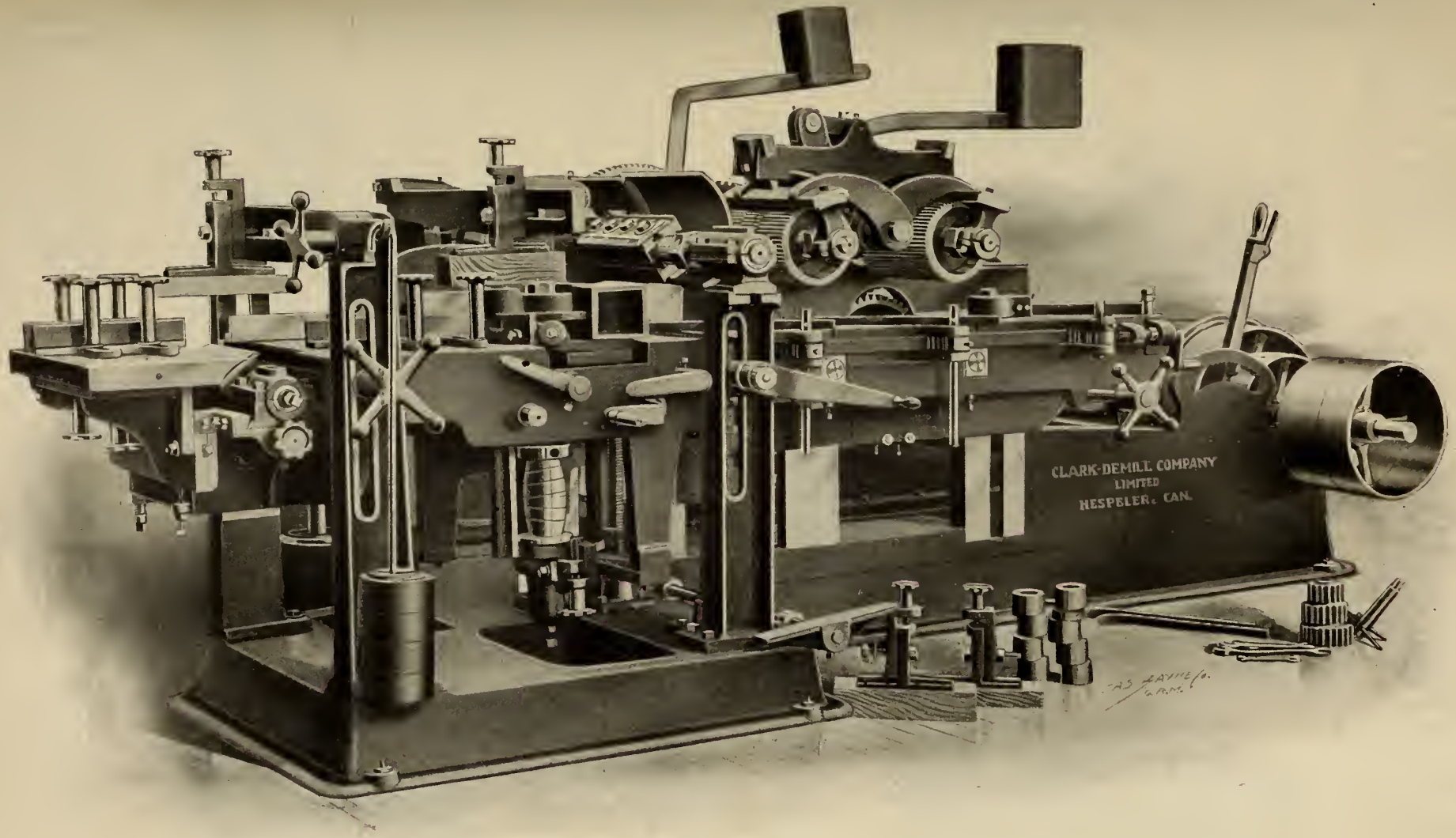

Extra Heavy Moulder, on Base

Planes 10 inches, 12 inches and 13 inches wide, by 12 inches thick. Has eight changes of feed, 11, 15, 19, 22, 25, 34, 42 and 50 running feet per minute.
Write us for circular describing this machine fully, and also for prices and description of our full line of wood-working machinery.

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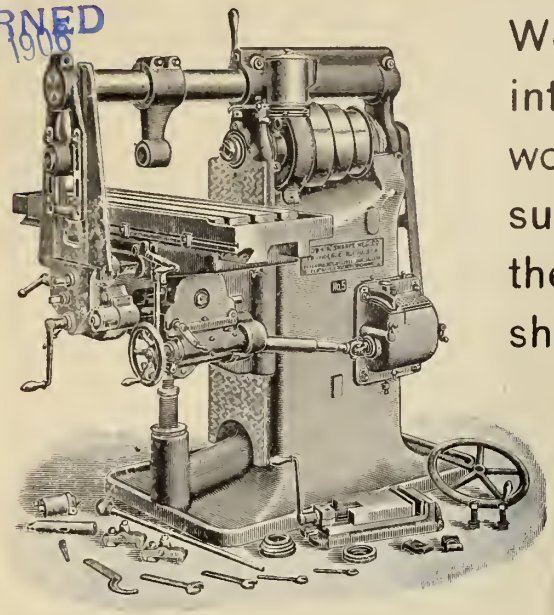

We represent the largest machine tool interests in the world, and can supply the wants of the smallest repair shop or the largest railroad or manufacturing plant.

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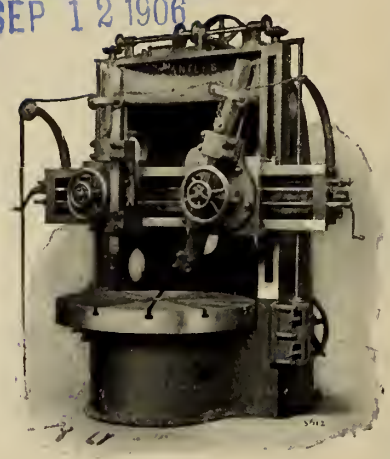

The Manufacturers whom we represent are old established concerns, whose product in design, workmanship, and general efficiency is of the highest standard.

WE ARE SALES AGENTS FOR THE JOHN BERTRAM & SONS CO., LTD., DUNDAS, - - - - ONTARIO.

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To Journ
Cut Book 65
Page 12
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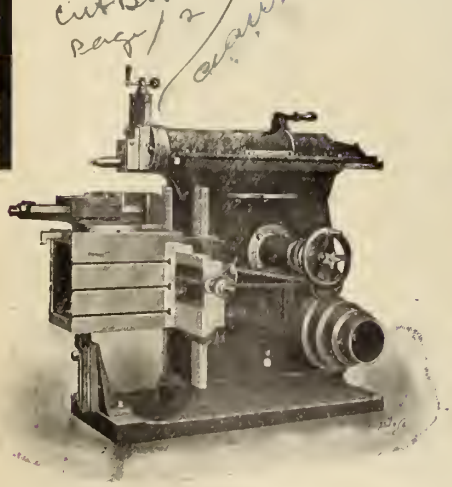

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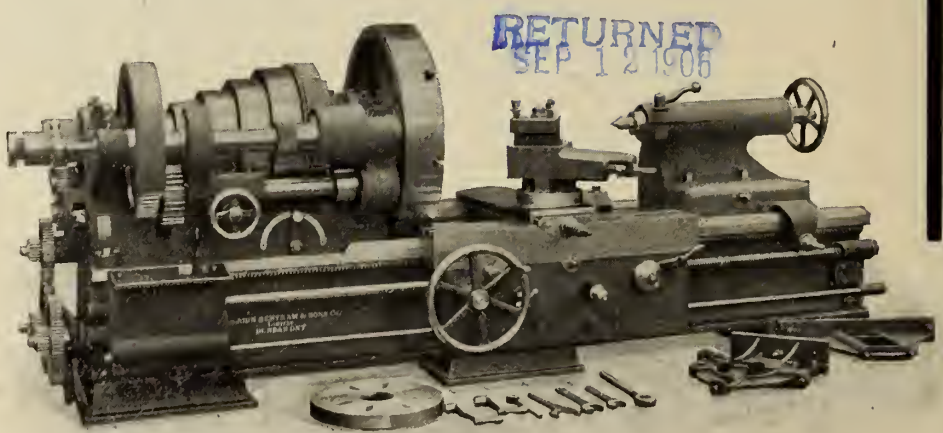


THE CANADIAN FAIRBANKS CO., Ltd.

Montreal **Toronto** **Winnipeg** **Vancouver**

Modern Canadian Manufacturing Plants.

ARTICLE XVIII.—New Plant of Chadwick Bros., Hamilton, Ont.

THE story of a business success is always worth telling, for who is not interested in and inspired by the knowledge that some other with only ordinary or less than ordinary chances has, through continued industry and progressiveness, developed a business from a very unpretentious to a quite pretentious standing? And thus the development of the brass goods industry of Chadwick Bros., Hamilton, will be of interest. Twelve years ago Chadwick Bros. was an unknown name in the industrial field, and the only evidence of such an industry was one machine in a cellar on a side street in Hamilton. There was practically no capital at the start, and the business has been built up in the oftentimes slow but of the sometime sure way of extending only as the profits of the business will allow, and not in the introduction of outside capital. The fact of the business having developed in this way from practically nothing to its present status, as shown in the size of the new plant, herewith illustrated, speaks well for the quality of the goods manufactured and the ability and progressiveness of those connected with the firm.

From the start there have been four brothers interested in the business—A. H. Chadwick, Frederick Chadwick, Chas. W. Chadwick, and John S. Chadwick. Each brother has charge of some department of the business, and the firm say that it is through this personal supervision that they are able to turn out the class of goods they do.

Plating Room : Chadwick Bros., Hamilton.

General Plan of Works.

The accompanying plan of the first floor of the new plant will show the general layout. There are two distinct buildings, one the main building and the other the brass molding shop. Both buildings are of brick construction with concrete foundations. The main building is a two-storey building with basement. It is divided into two distinct parts by a brick wall running from the bottom to the top of the building. One of these departments constitutes the general manufacturing plant, including the offices, while the other constitutes the storage and shipping departments. On each floor is an automatic fire-proof door between the two departments which, together with the brick wall, will prevent a fire in the factory from spreading into the storage and shipping rooms.

Heating and Ventilating.

The heating and ventilating system used is the hot blast system, installed by Sheldons' Limited. Fresh air is drawn through steam coils and is discharged into the building at the required points by means of galvanized pipes, the system giving a complete change of air every twenty minutes. The boiler supplying steam for the coils is heated by natural gas. The burners consist of six cast iron tubes, supplied with rows of holes running the entire length of the boiler, the correct amount of air being mixed with the gas before it is supplied to the burners. During the Summer two out of the six burners are run to supply steam for the heating of materials in the finishing departments.

Power and Power Transmission.

An induction motor supplies the motive power for the shafting throughout the building. The power transmission appliances, including the shafting, counter-shafting, hangers, etc., was installed by the Dodge Mfg. Co. The buildings are equipped with the Canadian Magneto fire alarm system.

The General Manufacturing Section.

In the basement of the general section is the blacksmith shop, the boiler room, the heating and ventilating apparatus and the scrap room. The floor of the basement is concrete.

The first floor is partitioned off into several departments, including the buf-

Brass Moulding Shop : Chadwick Bros., Hamilton.

fing room, the plating room, the press room, the dipping and sand blasting room, the finishing room and the lacquering room, the board partitions being to prevent stray dust from the buffingroom from penetrating to the plating room and the fumes from the acid baths and the lacquering process from spreading throughout all the departments.

Brass Finishing Room : Chadwick Bros., Hamilton.

The buffing room is equipped with buffers of the firm's own make and also of Hanson Van Winkle; and the room is kept clear of dust by a suction fan installed by Sheldons, Limited.

In the plating room the various plating processes are carried on, including silver, nickel, copper and brass platings. The plating dynamos were installed by Hanson Van Winkle. In all there are about 2,000 gallons of the different solutions in the plating room.

The press room is equipped with five presses, one drawing press, three stamping presses, and one drop press, the manufacturers represented being the London Machine Tool Co., E. W. Bliss Co., and McGregor-Gourley. The firm do most of their own stamping in ornamental brass work, only buying that class of pressed goods for which the demand is so small as not to be worth the investment in dies for the presses.

The brass goods are cleaned in acid baths or are sand blasted in the dipping and sand-blasting room according to whether the goods are to have a highly polished style of finish or the "satin" finish, sand blasting giving the latter.

In the finishing room the goods coming from the buffing room and dipping room are given the high finishing polish or are "colored," as it is called. From the finishing department the goods go to the lacquering department, where they receive their coat of lacquer.

The second storey of the general plant is all in one section, although there are several classes of work conducted in it, including brazing, chandelier fitting, metal spinning, brass finishing and tool making.

All the brazing is done with natural gas. The chandelier department is equipped with some special machinery of the firm's own make, including a line of punches, as well as the necessary bench tools required for chandelier fitting. The metal spinning process is very interesting, showing as they do the forming, in the spinning lathes, of sheet metal into any required shape. The spinning lathes were all built from the firm's own designs.

The equipment of the brass finishing department is very complete, consisting of some fifteen brass finishing lathes, representing the following makers: The Warner & Swasey Co., the Brown & Sharpe Mfg. Co., the London Machine Tool Co., McGregor-Gourley, and the Garvin Machine Co. A fitting bench runs down both sides of the department. Nearly all the tools and dies used by the firm are made by themselves, and for this purpose there is quite a complete tool room equipment, including two lathes, a McGregor-Gourley and a LeBlond, a McGregor-Gourley milling machine, four John Bertram drills, a shaper, and a special threading machine made by the firm themselves.

The Brass Foundry.

The molding shop has the ordinary equipment of a brass foundry, besides which there is installed a power sprue cutter, by the London Machine Tool Co., and a magnetic separator for the separation of brass turnings from bits of iron. There are in all ten brass furnaces, which furnaces, although at present using coke, will be equipped with natural gas burners. The floor of the molding shop is concrete. The lighting has been paid special attention with good results. At the end of the molding shop and separated from it by a brick wall and fire-proof door, is a

Lacquering Room : Chadwick Bros., Hamilton.

pattern shop, where a couple of men are continually busy. This department is looked after very closely. The users of brass castings have been unable in the past to procure castings free from holes, etc., and this firm is furnishing

Buffing Room : Chadwick Bros., Hamilton.

users of this class of goods perfect castings.

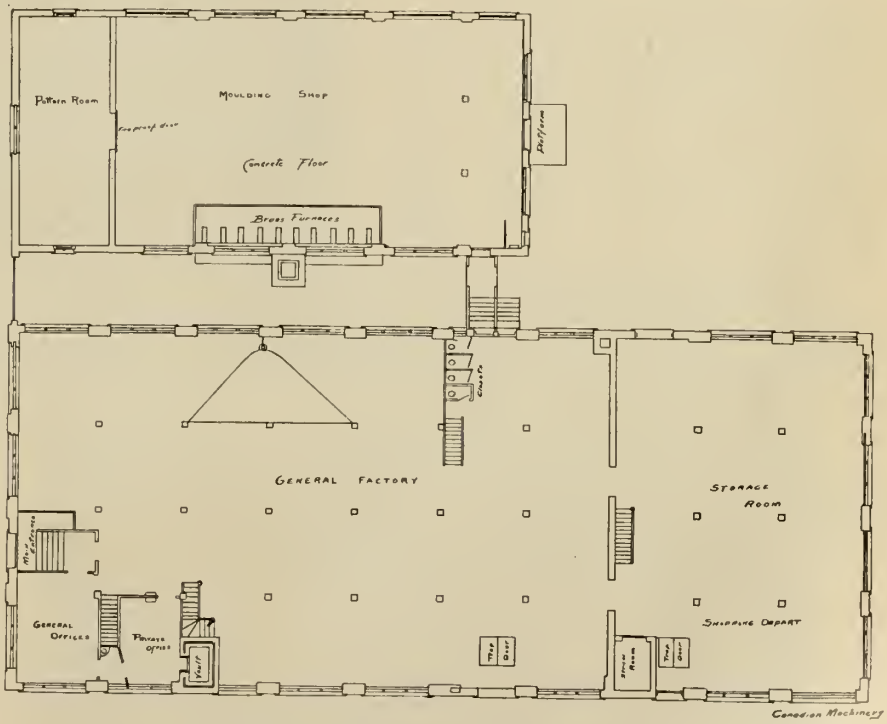
Shipping and Storage Facilities.

There is an immense amount of raw material and partially manufactured material kept on hand, as is evident from walking through the storage room. The second floor of the storage department is equipped with a two-ton hand crane, which runs out on its travel-way over the lane from where raw material is received. The shipping room has every convenience, including a straw storage department, which is a small chamber, concrete floor, equipped with fire-proof doors and a chimney, so that if the straw catches on fire the chamber acts as a stove and there is no harm done.

Conveniences for Employes.

Considerable attention has been given to the providing of wholesome conveniences for the employes. Each employe is provided with a locker, equipped with lock and key, and wash basin, each of which is numbered to correspond with the employe's number in the time system, which was installed by the International Time Record Co. Thus no dispute is likely to arise over either the locker or the basin. There is a bright, well heated and well ventilated lunch room in the basement, supdoubt the conveniences for employes plied with table and benches. Without are excellent.

Some of the goods made by the firm are : Engineers', plumbers' and steamfitters' supplies ; all kinds of gas and electric chandeliers; all kinds of ornamental brass or plated metal goods; all kinds of automobile, launch and carriage supplies and trimmings; brass water works supplies ; all kinds of office, bank and church metallic fittings; and the "Kingston" carburetter ; sections and church brass work, soda water fountains and confectioners' metal goods.



Ground Plan of Plant of Chadwick Bros., Hamilton.

BRITISHERS AWAKENING.

A NUMBER of important points in connection with the manufacture and sale of machinery in Great Britain, in so far as it affects American trade, are pointed out in a recent report by U. S. Consul Halstead, of Birmingham, Eng.

In British mercantile and engineering circles, he states, they are sometimes mildly sarcastic about the ease with which catalogues can be obtained from American manufacturers, disclosing designs, and even giving best discounts. In one case, which he knows, an applicant for catalogues and quotations of American products was a designer in the employ of an English concern, making articles in competition with the American firm, and it profited greatly by making copies of American articles. An application on a private letterhead or from aprivate address to an English firm, he states, would not receive any attention, and when made on business stationery would generally result in a personal call from one of the English concern's travelers, the object being to size up the applicant before quoting prices or letting him have the catalogue.

ARGUMENT IMPOSSIBLE.

Scene—A villa in a London suburb. Engineer from the supply company is going round with the lady of the house to find a suitable position for fixing the meter.

Engineer—I think we shall have to fix the meter at the back of this larder ; it seems to be the only place available.

Lady—Oh, dear ! I couldn't possibly have it there. A friend of mine has got it in the larder, and she finds it makes the meat taste so nasty !

The Canadian Fairbanks Co's. Warehouse.

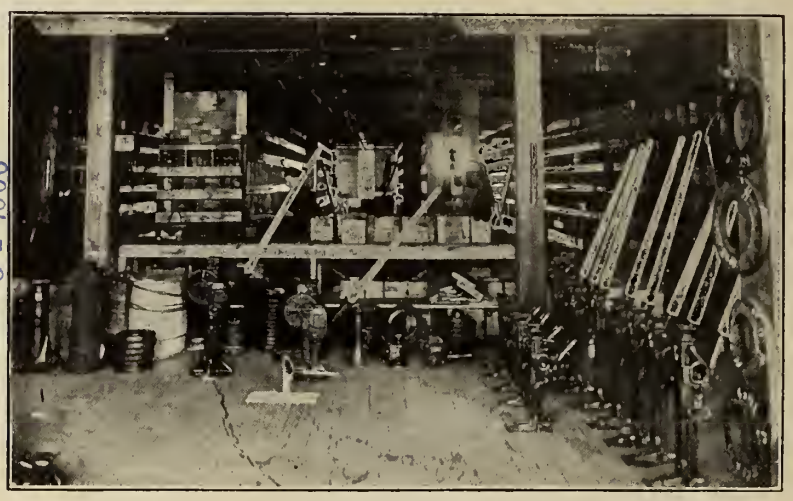
IT is just two and one-half years ago that the Fairbanks Co. established a warehouse in Toronto. This warehouse was destroyed in the Toronto fire of 1904, but a new building was at once started. In 1905 the business of the Fairbanks Co. was purchased by the Canadian Fairbanks Co., and at the same time arrangements were made with Fairbanks-Morse & Co. for the building of a plant in Canada for the manufacture of their product, the Canadian manufacturing firm to be known as the Fairbanks-Morse Canadian Mfg. Co.

The accompanying illustrations are of different sections of the new warehouse. The warehouse building is 41½ feet wide and 125 feet deep, and has five storeys and basement, representing a floor area of 31,122 square feet. The basement is used as a scale repair shop, and also as a gas engine floor. The ground floor is used as headquarters for the department managers, and as a sample room, the shipping room being in the rear of the same floor. The manager's office and the counting room, and also the valve and packing stock room are on the first floor. The second floor is devoted to cast and malleable fittings and steam specialties. The transmission department is on the third floor, and the fourth floor is devoted to standard scales.

Office and Counting Room : Canadian Fairbanks Co., Toronto.

The new manufacturing plant, which will be fully illustrated and described in a subsequent issue of Canadian Machinery, consists of the machine shop, the forge shop, the foundry and the power house. The machine shop is 285 feet long and 106 feet wide, and is two storeys in height, with galleries. The foundry is 72 feet wide by 130 feet long, and the blacksmith shop is 98 feet by 72 feet. The power house is equipped with two 180 h.p. suction gas producers, and Fairbanks-Morse gas engines belted to Fairbanks-Morse generators, which supply power for the individual drive motors throughout the plant.

The product of the plant at present will be gas and gasoline engines and steam pumps, although later on more lines will probably be added.



Pipe Fitting and Railway Supplies : Canadian Fairbanks Co., Toronto.

Sales Department and Show Room : Canadian Fairbanks Co., Toronto.

At the annual meeting of the shareholders of the Dominion Iron & Steel Co. at Montreal on June 29, the following directors were elected : Hon. Geo. A. Cox, H. F. Dimock, Hon. L. J. Forget, Hon. D. Mackeen, Hon. Robt. Mackay, Hon. Wm. McMaster, Frederick Nicholls, Sir Henry Pellatt, Dr. F. S. Pearson, J. H. Plummer, W. B. Ross, Elias Rogers, Sir Wm. Van Horne, H. M. Whitney, E. R. Wood. At a meeting of the directors J. H. Plummer was elected president and Hon. L. J. Forget, vice-president.

Edmonton's Call for Factories

By F. R. Munro.

EDMONTON offers to the Eastern Canada manufacturers some very attractive inducements to follow the movement westward and establish in the Alberta capital branch factories, which in less than a generation will probably be as large as, or larger than, the present size of the parent factories in the east. Edmonton is calling for industries, a large and rapidly increasing market in the vicinity of Edmonton

Scale Stock Flat: Canadian Fairbanks Co., Toronto.

is calling for manufactured goods; and Edmonton's call will not long remain unheeded, the Alberta market will not always be supplied with manufactured goods from the east. Manufacturers will appreciate the opportunities in Edmonton and they who "get in on the ground floor," those who are first to commence operations, will reap the largest benefits. If Canadian manufacturers do not seize the opportunity others will.

The Lesson of History.

Perhaps the Canadian manufacturer who reads this will remark that it is an old story, that the market is limited and he can very well continue to supply it from his eastern factory, that Edmonton is an over-boomed town, that there is bound to be a crash sooner or later, that the time isn't yet ripe for branching out in the west.

But what is the lesson of history? From the very first, Western Canada has suffered (and the east has also suffered) from the timidity and lack of confidence of the people of Eastern Canada. The great majority of both political parties lacked faith and were wanting in those powers of imagination without which men can accomplish very little constructive work.

The Initial Boom.

When the C. P. R. was building adventurous and restless spirits from the older provinces moved west, and very soon their hope of agricultural, commercial and industrial possibilities became profound conviction. They began to tell their eastern friends of the great opportunities in the new Canada beyond the lakes.

The boom of the early '80's, an eastCanadian boom almost wholly, rose and fell, enthusiasm waned, faith turned to doubt and for ten years the east lost interest in the west. The dauntless spirit of those whom the prairies had adopted kept up the propaganda and a few responded to their call.

Still Want Men.

The west still called for Ontario farmers and there still traveled eastward the same stories of the fertility of the western soil. Two Ontario counties, Huron and Bruce, responded to the call, but for the most part the invitation came to too cautious or unheeding ears. There could be nothing but "western blow" in the stories he heard of western opportunities. So the eastern farmer stayed where he was, in many cases to eke out a scanty existence on a stoney 50 acres when he could have had for the asking 160 acres of the most fertile soil in Canada.

The Eastern Canada farmer lacked faith!

No one now doubts the agricultural possibilities of the west for they have been proven by a succession of golden harvests, and thousands are moving into the land of promise. The appeal to Eastern Canada had for years fallen upon deaf and skeptical ears, and the west then turned to the United States with its story; and the result was that in two years more settlers came from the United States than had come from Eastern Canada in the preceding ten years.

The Manufacturers' Testing.

Will the Eastern Canada manufacturer be wiser than was the Eastern Canada farmer from 1885 to 1900? Just as insistently as the west called to the east for settlers it is now calling for manufacturers, and with stronger claims, for while there is still plenty of land for the newcomer, the manufacturing trade, once secured, will be held,

Scale Repair Room: Canadian Fairbanks Co., Toronto.

and those that get in now will grow with the country.

Winnipeg, Regina, Calgary, Edmonton and other centres present strong claims upon the serious attention of the

RETURNED JUL 31 1906

RETURNED JUL 31 1906
To Dunn
Cut Books
Page 20

eastern manufaeturer and it remains to be seen whether he will profit by the lesson of the last two decades, or whether he will wait for the American manufacturer, with his optimistic aggressiveness, to show him the way. Does the Eastern Canada manufacturer also lack faith? The next two years will answer the question.

American capital has reaped the largest profits from land speculations, and there is now very little land remaining which ean be obtained by capitalists en bloc; but American faith in the future of Western Canada is growing stronger every day and there is nothing more sure than that if the Canadian manufacturer does not soon awaken to his opportunities, American capital will very shortly build large factories in the farthest west. People will not forever be content to send 2,000 miles east for their goods, and the manufacturers who first commence to supply Alberta with goods "made in Alberta" will be apt to secure and hold the Alberta trade. The market is already a large one, but it is only in its infancy. A generation from now it is more than likely that the population west of the lakes will be larger than the population east and the western market will be larger than the eastern! Will it be served by Canadian manufacturers who have established their factories in the west or will it belong to the alert Americans?

RETURNED
JUL 31 1906
Folumn
Cut Book 53
Page 20

Valve and Steam Goods Flat: Canadian Fairbanks Co., Toronto.

What Edmonton Offers.

What, then, are the special advantages which Edmonton offers to the manufacturer? Cheap power, abundance of raw material, good transportation facilities for the assembling of raw materials and for the distribution of the finished products, and proximity to a good market—these are the prineipal requirements of a good manufacturing town, and all of these Edmonton has to offer.

Cheap Power.

Is there any other place in the world where abundanee of good coal may be had at $1.50 per ton, where expensive mining operations are not required, but where the coal may be loaded directly into barges and wagons? This is what Edmonton has to offer in the way of cheap fuel and consequently cheap power, and apparently she can offer it in practically unlimited quantities. For miles in all directions from Edmonton there is abundanee of good coal at a very small depth below the surface of the ground. Extensive mining operations have not yet been attempted; no shafts have yet been sunk, all the mining being done on the level. The coal has practically all been obtained along the high river banks into which the miners dig and load their coal directly into barges. Until a short time ago coal was selling in Edmonton at $1.50 per ton; at the present time, owing to temporary circumstances, the price is a little higher. Practically the whole cost is transportation, and as teamsters are now commanding wages of $4.50 to $5 per day, as compared with $3 a short time ago, the price of coal has been slightly advanced. With mining operations on a large scale and up-to-date methods of delivery, coal will be less than $1.50 per ton. This coal is well adapted for both manufacturing and domestic purposes, and there are great opportunities for the development in Edmonton of an immense coal mining industry.

Coal being so cheap, little attention has yet been paid to the development of water power; but Edmonton is rich in "white coal" as well as in black, and should the supply of the latter ever be exhausted there is any amount of the former now going to waste. The city now has its own electric light and water plants and is prepared to assist small industries by supplying cheap power, water and light.

Transportation Facilities.

Abundant raw material for various industries is also close at hand, but as this phase of the situation can be best treated by example it is discussed below in connection with specific industries. Equally important is the question of transportation. Two railways, the C.P.R. and the C.N.R., now serve Edmonton and a third, the G.T.P., is assured in the very near future. While the plans of James J. Hill are not yet definitely known, it is unlikely that he will overlook Edmonton. It may therefore be safely assumed that in the very near future Edmonton will be served by four different railroads.

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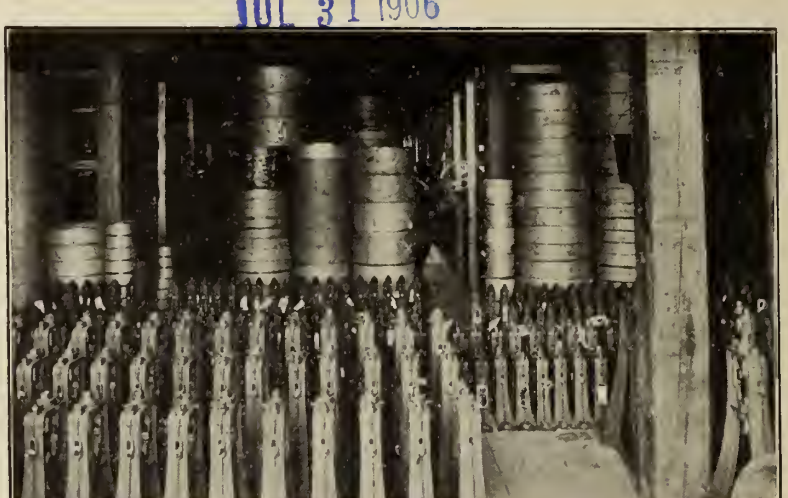

Transmission Stock: Canadian Fairbanks Co., Toronto.

The Market.

What of the market for Edmonton-manufactured goods? Not so large yet as it very soon will be, but nevertheless a market of respectable proportions. Moreover, it is a market with larger

proportionate buying powers than a market in the east. Westerners make money more easily than easterners and they spend it more readily. At the present rate of immigration it will be a very short time until there are as many people west of Winnipeg as east.

Pipe Shed: Canadian Fairbanks Co., Toronto.

The manufacturer first in the field will possess a very considerable advantage. Some manufacturers somewhere will very soon appreciate the possibilities of profit in supplying western people with western-made goods. If the Canadian manufacturers do not seize the opportunity others will.

Soap Makers.

As a consumer of by-product the soap factory is a natural adjunct of the packing industry. At the present time there are two soap factories in the west with a third projected in Saskatoon. These factories can not supply the rapidly growing western market. Eastern-made soap is sent in by the carload. A factory in Edmonton would be in a splendid position to compete for western business.

Although Edmonton is a milling centre of considerable importance, every pound of biscuits consumed in Alberta is brought hundreds and thousands of miles over railroads which have already hauled east the wheat or flour of which the biscuits are made. Is it reasonable to suppose that this will continue indefinitely? There can be but one answer, and again the question arises whether the industries of the Edmonton to be will be built by Canadian or by American capital.

Flour and Cereal Mills.

Already the flour milling industry of Edmonton and the neighboring town of Strathcona has reached large proportions, but it is capable of great expansion and the production of cereals has scarcely commenced. Oats weighing 40 pounds per bushel are ordinary in Alberta and 48-pound oats are not uncommon.

There is a heavy demand in the west for building material, including paint, and consequently a large market for linseed oil, which makes the opportunity for linseed oil mills at Edmonton. The Alberta climate is admirably adapted for the growing of flax.

Pressed Brick Works.

The manufacture in Edmonton of pressed bricks is already a very considerable industry and the product is entirely consumed in the home market. Orders have come unsolicited from as far east as Winnipeg, but Edmonton manufacturers are not yet able to fill them. This industry is capable of large expansion.

Edmonton is also a lumbering centre of some importance, the mills cutting about 20,000,000 feet of lumber last year. A new mill is now being built which, it is estimated, will increase the output 50 per cent. The timber is brought down the Saskatchewan River and the supply will last for many years to come. An integral part of the lumber industry is the planing mill and sash and door factory, and they are on a large scale in Edmonton. These manufacturers are branching out and are now making a fine line of bank and office fittings as well as store fixtures, etc.

Manufacturers Coming.

In one months' time the Canadian Manufacturers' Association will come west to their annual convention in Winnipeg. Following the convention there is to be a tour of the west, and Edmonton is among the points to be visited. Manufacturers will then have opportunity to see for themselves the solid advantages which Edmonton has to offer. They will appreciate the opportunities offered by cheap power, unsurpassed distributing facilities and a rapidly growing market. They will also appreciate the equitable system of taxation in force in Edmonton, for the city has practically a single tax. Land values only are taxed and a manufacturer is not fined by the city, by the way of increased taxes, when he erects valuable buildings. Moreover, the rate of taxation is not high, the average for several years having been about 16 mills.

When they consider all these advantages, it is confidently believed that many Canadian manufacturers on their western tour will decide to establish branches in Edmonton. One thing is certain, industries Edmonton must and will have; whether Canadian or American remains to be seen.

Coal Mining Near Edmonton.

CANADIAN MACHINERY
and Manufacturing News

A monthly newspaper devoted to machinery and manufacturing interests, mechanical and electrical trades, technical progress, construction and improvement, and to all users of power developed from steam, gas, electricity, compressed air and water in Canada.

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NEW ADVERTISERS IN THIS ISSUE:

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Dominion Henderson Bearings, Limited, Toronto.
Gillespie, W., Toronto.
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London Machine Tool Co., Hamilton.
Morse Twist Drill and Machine Co., New Bedford, Mass.
Osborn Manufacturing Co., Cleveland, Ohio.
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THE FIGHT FOR BLUE SKY.

FOR years the agitation to do away with the smoke nuisance in large cities has been going on. Laws have been passed to restrict the nuisance and fines imposed from time to time with more or less success. The matter is receiving more than usual attention at the present time in the United States and Canada. In Montreal and Toronto there is no more prominent subject before the people. That the nuisance can be abated or at least very nearly so, has been demonstrated from the results obtained in cities in the United States, where, under the direction of a supervising engineer, careful tab has been kept on every stack in the city. It has been the policy of the inspector to a large extent to employ educational methods and persuasion rather than compulsion. This method has accomplished successful and evident results.

In Toronto, according to Property Commissioner Harris, the foregoing method has been adopted, and although the results have not come up to the expectations of the general public some good has been done. It is hard, however, for a municipality to expect manufacturers and others to conform to a law which it itself passes by with apparent contempt. The City of Toronto is the greatest offender within its limits, of the smoke nuisance, particularly on the harbor front, where every day and for long periods great clouds of black smoke belch forth from the civic plant to darken the surrounding atmosphere. The excuse is made that apparatus installed to avoid this does not work satisfactorily, but until the city can set the manufacturers a better example it is in a poor position to expect the carrying out of the by-law on the city's statutes to restrict smoking chimneys.

Ahead of manufacturers as offenders in the smoke question comes the railroad. The railroad section of any city generally is the smokiest part, and anything that could be devised to abate this nuisance in railroad yards would be welcome. It was announced at the smoke abatement convention in Detroit that such an apparatus had been adapted to steam locomotives which could be installed at small cost. We have not yet seen anything of this, but should the report be true the railroad corporations will no doubt be quick to adopt it.

While manufacturers are not by any means the greatest offenders in this connection, there is a great deal that can and no doubt will be done by them in the near future to remedy the situation. Going to the root of the trouble, very often the design of the furnace is at fault, and in the past whatever boilermakers chose to recommend has been much too readily accepted. The furnace construction, according to the best authorities, must be adapted to the fuel, and it is absurd to suppose that furnaces designed for burning anthracite or semi-anthracite will satisfactorily burn fuels containing 30 per cent. or more of volatile matter. The percentage of volatile matter which a fuel gives off when heated is in fact a measure of the size of the chamber required for its complete combustion, and it is here that the laboratory examination of fuel yields results of the greatest value. That such an examination is still regarded as unnecessary and is no help in the placing of contracts, is clear proof of how much is still to be learned in the scientific control of a steam plant. In designing a plant let the manufacturer insist that the designer is not denied to plan such that at a small additional cost will give him a furnace admirably suited to his requirements. The furnace must fit the fuel, there is no getting around the fact, and, likewise, the furnacing must be properly done.

A custom is too much in vogue among manufacturers to hire any laborer who may be handy to fire his boiler, when in reality to have it properly done requires not only experience but expert handling and good judgment. A good fireman will pay for the difference in additional cost by greater economy of fuel consumption many times over in a year. If manufacturers were only alive to this fact the smoke nuisance would be greatly abated. An expert fireman can keep up steam and have very little smoke appearing from the chimney, provided he is laboring under favorable conditions, when at the hands of a poor or inexperienced fireman the smoke nuisance will be at its height.

Mechanical stokers have and are doing heroic service in this connection. Some go as far as to say that they are absolutely the only cure for smoke with smoky fuel. Without going as far as that, it is safe to assert that their general adoption under present conditions will go a long way towards relieving the situation. To bring about the millenium in this direction it will be absolutely necessary for all hands to co-operate. Municipalities must begin by setting a good example, railroads

must adopt the latest methods available and manufacturers must accept a reasonable view of the situation and take what steps that lie in their power towards rendering the atmosphere of our larger communities more fit to live in.

SPLENDID CROP PROSPECTS.

THE prosperity of Canada being directly dependent upon her agricultural industry, it is gratifying that reports received from authoritative sources find the crop prospect very satisfactory. Interest in this regard turns primarily to the west, with each year a greater field to be reckoned on. Thousands of acres of rich prairie are being broken by the settler every day, and next season will add their quota to swell the immense grain product. Last year's yield, considered by the acre or as a whole, was wonderful, and if Nature is propitious the crop now in the ground will, by reason of increased acreage, far surpass it. What the influx of people will be during the present Summer it is difficult to estimate, but it will constitute another movement of the entering wedge that is to bring this fair Dominion a population of fifty millions in a few decades, and raise Canada's standard to a high place among the nations of the world.

All this means an agreeable situation to the manufacturer, who looks to the west as a the great receiving ground of his output, relieving him of any anxiety regarding future demand in view of lack of prosperity. When the farmer smiles everyone smiles, so that there is every indication of smiling days in Canada, not only for the farmer, but for the laborer, the mechanic, the merchant and the manufacturer.

JULY METAL FEATURES.

UNSETTLED conditions characterized several items on the metal list during July, and nearly all the prominent commercial metals are selling at lower prices now than they were a month ago.

Tin has been the most unsteady of all. Fluctuations were almost daily and became so violent that leading Canadian metal merchants refused to quote prices except on receipt of specifications. The tendency, however, was generally downward, and at the present time a price of 43c. is easily obtainable. Even that figure will be shaded for good round lots.

Pig lead had declined steadily up to the middle of the month. The opening of each week saw a slight rally over the conditions at the close of the previous one, but until the time mentioned quotations had gradually eased off so that a price of $4.30 per hundred pounds was reached. A sudden reaction then set in. Almost immediately an advance of 10c. was declared, and at time of writing the bulls are apparently in control of the market, with every natural condition in their favor.

Zinc spelter aroused considerable interest early in the month by advancing about half a cent on this side of the ocean, due to an invasion of the market by European buyers. It was not long before producers were sold out for months ahead. But some operators who held large stocks of the metal suddenly unloaded, through a desire to realize at once instead of awaiting developments, and the price on most brands fell to practically the old quotations. There is a tremendous demand for galvanized sheets and other materials into which spelter largely enters, and the probability is that values will again be enhanced.

The arrival of reasonably large stocks of antimony created a sagging movement in that market. The price, which had gone up to over 30c., dropped to 28c., and concessions for large orders are given on that quotation. Even so, conditions are most abnormal, quotations being about four times what might be termed the regular price of antimony.

Copper is the only ingot metal which has steadily maintained its strength throughout the month. Many large Canadian dealers who sent in their specifications to producers have been informed that these could not be filled for some time to come. The price, however, has remained without change, as it is said that producers, wishing to ensure evenly distributed deliveries, have discountenanced an advance.

MACHINE TOOL SITUATION.

NOT in the history of the machine tool trade in Canada has there been such a peculiar situation as exists to-day. Owing to the unprecedented demand for all classes of machine tools manufactured both in this country and in the United States, the makers have become far behind in their orders. Not long ago thirty and sixty days' delivery was considered excessive. To-day orders are being taken for delivery in the Spring of 1908, and scarcely any order on any line under ninety days. All this is a remarkable evidence of the prosperity of this country. Machine tool manufacturers and agencies are not mourning over the lack of supply. The whole tendency of the inability on the part of manufacturers in general to receive machine tools within a reasonable time has reacted for good. On not being able to receive the machines better and deeper plans for the future have been laid, with the result that instead of ordering fewer machines orders for more have been placed.

One of the largest machine tool firms in Canada finds itself without a machine tool in its warehouse, and with no prospect of any change in the situation for several months to come. In view of the fact that such conditions exist there is every reason to believe that not only will manufacturers plan much more than heretofore for the future, but also to work their present equipment with the greatest economy.

CANADIAN TRADE WITH UNITED STATES.

PEOPLE generally are not aware of the immense value of goods imported into Canada from the United States each year. During last year the total amount of these imports was over $152,000,000, or nearly three times the amount imported from the United Kingdom. On the other hand, Canada is finding a market within the domains of Uncle Sam, which trade is increasing in a satisfactory manner.

Recently a good move has been made by superintendent of commercial agencies, Mr. F. C. T. O'Hara, at Ottawa, in enlisting the active support of the British consuls throughout United States in favor of Canadian trade extension. During the month of March past Canada imported from the United States $15,000,000 worth of goods, one million and a quarter more than in March last year. In the same time Canada sold to the States a little less than six and a half millions worth. This shows that Canada's sales to the United States are not only capable of expansion, but that they are expanding in a satisfactory manner. The British consular service in the United States is ready to help to further increase this trade. Canada is developing at a much greater rate than the United States, and consequently is becoming a better market with each succeeding season, but as her own resources are being developed she is reaching a position where more and more an outside source of trade can profitably be sought.

Electro-Thermic Smelting Experiments

A History of the "Soo" Experiments, Based on the Preliminary Report, Recently Issued by the Mines Branch, Department of the Interior.

IN December, 1903, the Dominion Government appointed a commission to go abroad and investigate the different electro-thermic processes for the smelting of iron ores, and the making of steel, then being operated in Europe. The only experiments, however, which the members were able to witness were those made by Dr. Heroult at La Praz, and Mr. Keller at Livet, France.

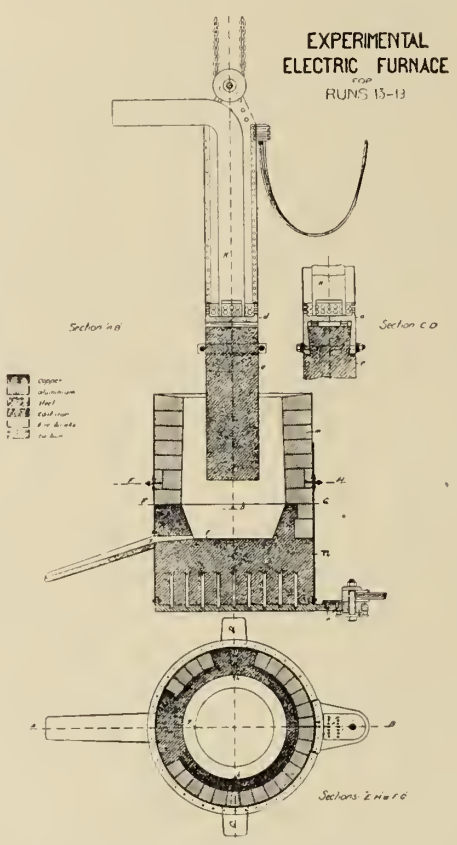
In the former case, the results were not such as to permit any reliable conclusion to be drawn, and, in the latter, experiments with widely divergent issues, were conducted on a very porous hematite ore containing a small percentage of sulphur. As Canadian ores are largely magnetite, with a comparatively high sulphur content, none of these experiments could be said to have been satisfactory, as they left undecided not only the amount of electric energy required per ton of product, but also the following important points, referring to Canadian conditions: "1st. Can magnetite, which is our chief ore and which is to some extent a conductor of electricity, be successfully and economically smelted by the electric process? 2nd. Can iron ores with comparatively high sulphur content but not containing manganese be made into pig iron of marketable composition? 3rd. The experiments made at Livet with charcoal as a reducing agent in substitution for coke having failed, could the process be so modified that charcoal, which can be cheaply made from mill refuse and other sources of wood supply useless for other purposes, could be substituted for coke? This is especially important since charcoal and peat-coke constitute home products, while coal-coke for metallurgical processes requires to be imported into the Provinces of Ontario and Quebec."

The solution of these problems was necessary before any judgment could be passed on the probable success of electric smelting in the Canadian ore fields, where water power is plentiful, but metallurgical coke is expensive, through lack of coal. Therefore, the Government authorized a series of experiments in electro-thermic smelting of Canadian ores, which were to be carried on under Government auspices. As the Lake Superior Corporation offered every facility for carrying out this purpose, the experiments were conducted at Sault Ste Marie by Dr. P. Heroult himself.

Preparations for Experiments.

The furnace used for the experiments proved to be unfitted for some of the charges, and defects were shown which could be remedied in those of larger capacity should the process be applied commercially.

In charging the furnace, which was lined with common fire brick, a crucible consisting entirely of carbon, was adopted. The electrodes were manufactured in Sweden on the Heroult principle and the contact was conveniently arranged for regulation by hand. The current was led from the transformer to the bottom plate contact of the furnace by conductors consisting each of thirty aluminum cables $\frac{5}{8}$ inch in diameter. Measuring instruments were provided so that it would be possible to exactly estimate the amount of electric energy consumed.



Electric Furnace Used in Soo Experiments.

The Experiments.

About the middle of January the experiments began and were carried on almost continuously until March 5, with the result that some 150 casts were made, produeing 55 tons of pig iron. Difficulty was experienced in stoking, as the space between the walls of the furnace and the electrode was too narrow. It was shown, however, that in a furnace so constituted that the electrode could be kept isolated from the charge, production might be considerably increased by the introduction of an air blast.

Cost of Production.

It is estimated by Dr. Haanel, superintendent of mines, that the largest unit which can at present be constructed on the model of the furnace employed in the experiments, will not exceed 1,500 h.p. On this basis, allowing for a normal annual production and assuming cost of developing 1 electric h.p. as $50, the production of pig iron by electrothermic smelting would approximate $10.69 per ton.

Summary of Results.

The actual conclusions reached from the "Soo" experiments are thus summarized in the preliminary report:

"1st. Magnetite can be as economically smelted by the electro-thermic process as hematite.

"2nd. Ores of high sulphur content not containing manganese can be made into pig iron containing only a few thousandths of a per cent. of sulphur.

"3rd. The silicon content can be varied as required for the class of pig to be produced.

"4th. Charcoal, which can be cheaply produced from mill refuse or wood which could not otherwise be utilized, can be substituted for coke as a reducing agent, without being briquetted with the ore.

"5th. A ferro-nickel pig can be produced practically free from sulphur and of fine quality from roasted nickeliferous pyrrhotite.

"6th. The experiment made with a titaniferous iron ore containing 17.82 per cent. of titanic acid permits the conclusion that titaniferous iron ores up to perhaps 5 per cent. titanic acid can be successfully treated by the electric process."

Apparently all that remains to assure the success of electric smelting of Canadian ores is a furnace of altered model, which will obviate the difficulties experienced in the experimental plant. The future of our northern ore fields is staked on the outcome of efforts along these lines. If they are satisfactory, the presence of abundant water power and unknown quantities of magnetite ores will off-set the absence of coal, and there will be nothing to prevent the rapid building up of Canada's iron and steel industries.

Belting and Transmission of Power

BY C. CHARLES MAISON, E.E.

THE transmission of power by means of belts is a subject of great importance, and one that should receive much study and thought from the practical machinist and others. A better knowledge of the characteristics of belting, and the problems of belt gear-

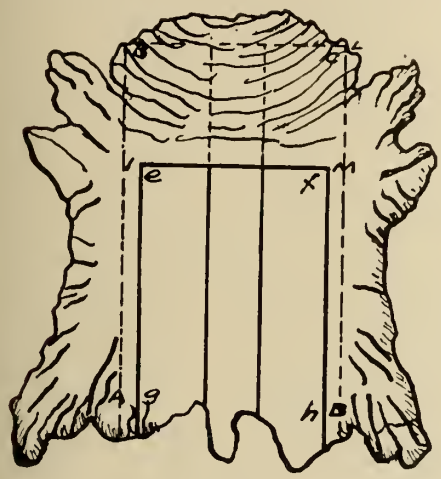


FIG. 1.

ing, increases materially the respect of the average mechanic and engineer for a piece of good leather.

We all, more or less, know that a belt is a flexible band passing over two or more pulleys for the purpose of transmitting motion from one to the other. As its drive depends on its frictional resistance to slipping, and as it is of a more or less elastic nature, it cannot be depended upon for transmission of exact velocity ratio.

Classes of Belting.

There are two general classes of belting, flat and round, the former being used on crowned pulleys and the latter on grooved or sheaved pulleys. The materials used in the manufacture of belting are leather and cotton for flat belts, and leather, cotton and manila for the round belts. Rubber is exclu-

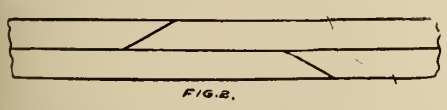


FIG. 2.

sively used on cotton belting for increasing the driving power and rendering them water proof, but of all these materials leather is the most important.

Making of Leather Belting.

In Fig. 1 is illustrated the character of the leather used for belting. The portion included in the dotten lines (A, B, C, D), is used for the various grades of belt, and is termed a "butt." The portion of the hide outside the "butt" is soft and flabby and, although frequently used in cheap belts, is really unfit for belt making. The portion (E, F, G, H), is used for making the best class of belting, it being the strongest and most uniform part of the hide, while the part (I, K, L, M), is known as the shoulder stock, and is used for the lower grades of belting.

All hides used for belting leather should be carefully tanned, and afterwards curried or softened by "stuffing" with hot grease, a process which lubricates the fibres of the leather and converts the hard, dry hide, as left by tanning, into a strong, pliable leather.

Best Arrangement of Leather Belting.

Double belts are used for transmitting greater power than the single belt will satisfactorily stand. Usually for driving belts it is better to use a double belt than a single one of greater width. Light double belts make good shifting belts, where there is considerable wear on the edges of the belt. A double belt should not be used on pulleys of too small diameters, as the short bend over the pulley tends to crack the leather. In a piece of leather belting the

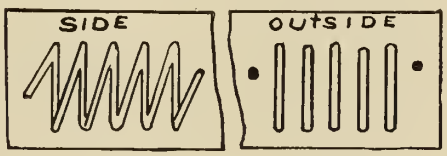


FIG. 3 FIG. 4.

strongest section is on the flesh side, the hair side being hard and liable to crack. For this reason the hair side of the belt should be run next the pulley, as it brings the fibres on the flesh side, which can best resist the strain, under tension as the belt passes over the pulley, and the fibres on the hair side under compression.

Power Transmitted by Leather Belting.

The power that can be transmitted by a belt varies widely, according to conditions, and consequently fixed rules cannot be laid down for the calculation of belt powers. Since a pull of 33,000 lbs. through a space of one foot in one minute represents one horse-power of work, a pull of 33 lbs. through a space of 1,000 feet in one minute would represent the same amount of work. Thus, by increasing the velocity or the tension, the work performed is correspondingly increased.

The working strain on good leather belting may be taken at from 45 to 60 lbs. per inch of width for single belts, and at double that for double belts. From the above, a heavy single belt running at 1,000 feet per minute will transmit 1.8 h.p. per inch of width, and a double belt at the same speed would transmit 3.6 h.p. per inch of width. At 4,000 feet per minute these same belts would transmit 7.2 and 14.4 h.p. per inch of width, respectively.

Excessively tight belts should be avoided, not only because of the injury to the belt, but because of the excessive strains on shafting, boxes and pulleys.

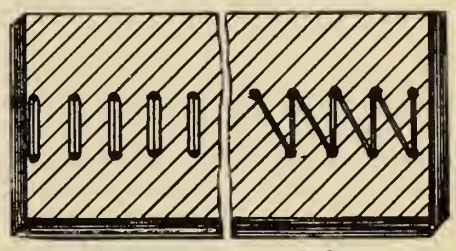


FIG. 5. FIG. 6.

Covering the face of the pulleys with leather increases the coefficient of friction of the belt from 30 to 40 per cent. A cover of this kind must be carefully put on to secure the best results, the leather from which it is made being scraped to uniform thickness and fitted closely over the pulley.

Joints in Leather Belting.

Whenever the character of the work permits, leather belts should be made endless by beveling the ends and making a glued lap joint. This constitutes a strong joint which runs smoothly over the pulleys. This is most important in the case of high speed belts operating on pulleys of small diameters. In double belts the joint should be lapped as shown in Fig. 2. It is not necessary to use rivets or other fasteners in connection with the glued lap

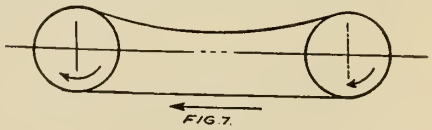


FIG. 7.

joints. In fact the best practice now dispenses with them entirely. In gluing

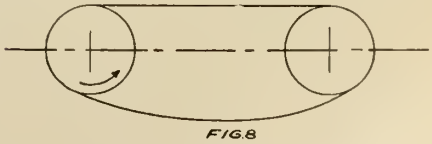


FIG. 8

joints, however, special glue should be used, and should be applied hot to both surfaces, in order that it may penetrate well into the pores of the leather.

The time-honored method of lacing belts with thongs of rawhide has about given place to the better practice of

using wire lacing, or to a limited few of the many patented belt fasteners. The usual trouble with fasteners arise not from the fastener itself, but from its improper application. Heavy belts should, for gluing or lacing, be drawn together by means of belt clamps. The holes should be punched exactly opposite each other and should be the small-

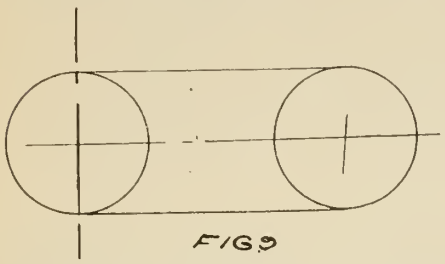


FIG 9

est possible that will let the lacing through. In the case of rawhide lacing, the usual mistake of using too few strands and too heavy a thong should be avoided. In Figs. 3 and 4 are shown very satisfactory methods. The strands on the inner side should be about $\frac{5}{8}$ of an inch apart, and the staggering of the holes gives a firm hold on the ends of the belt. In Figs. 5 and 6 are shown the method of lacing belts with wire lacing. The method is practically the same as with thongs. The wire used is of comparatively high tensile strength and very pliable.

Methods of Driving.

In the majority of cases belts are used to connect parallel shafts. When shafts rotate in the same direction the connecting belt is called an "open" belt, and when they rotate in opposite directions it is called a "crossed" belt. The "arc of contact" is that portion of the pulley's surface covered by the belt. It is evident that the "arc of contact" is greater with the crossed than with the open belt, and that a crossed belt will, other conditions being equal, transmit more power than an open one. Wide crossed belts should be avoided in cases where the shafts are close together. For narrow belts 10 to 15 feet are good centres when the belts are operating over pulleys of comparatively small diameters. When possible the lower side of the belt should

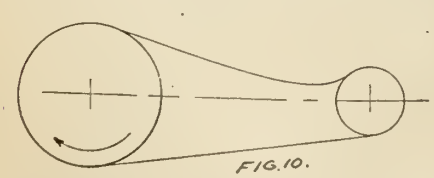


FIG.10.

be the tension or driving side, making the condition as shown in Fig. 7. If the top side is the driving side, the condition becomes as shown in Fig. 8. The arc of contact in the first case is much greater, and as a consequence a more powerful drive is obtained than in the latter case, all other conditions being equal. When parallel shafts in a vertical plane are connected as shown in Fig. 9, the tension must be much greater than in the cases already referred to, inasmuch as the height of the belt tends to hold it away from the lower pulley. When the difference between the diameter of the pulleys is great, a heavy belt on fairly long centres, run as shown in Fig. 10, should be used whenever possible. When centres are close and a tightner becomes necessary, it should always be put on the slack side of the belt, as shown in Fig. 11. This location puts a minimum amount of pressure on the tightner and its bearings. Tightner pulleys should be of liberal diameter in order to prevent noise and wear due to high rotation and injury to the belt due to a short reverse bend.

In Fig. 12 is shown a method of driving two parallel shafts from a third parallel with them. One belt runs on top of the other on the driving pulley.

When belts are not to be shifted the usual method of guiding is by crowning

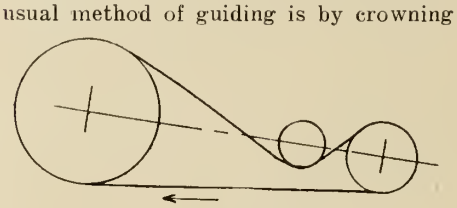


FIG.11.

the face of the pulleys. The belt then tends to run on the high part of the pulley for the following reasons: If,

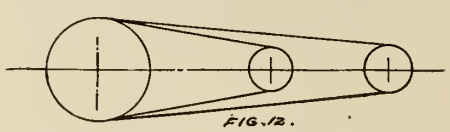


FIG.12.

as shown in Fig. 13, the belt is forced to one side, the edge (a) becomes stretched, making that part of the belt in contact with the pulley's surface of conical shape, with the edge (a) traveling faster than the edge (b), thus causing it to run in the direction of the arrow and to centre itself on the pulley.

Thus, when the shafts are parallel, the belt always runs to the high part of the pulley. If, however, the shafts are not parallel, and the high side is caused by the position, and not the shape of the pulley, as shown in Fig. 14, the belt runs to the low edge as it passes on to the pulley in a spiral direction, and all points where they first come in contact with the pulley's surface are carried in the direction of the pulley's rotation as indicated by the arrow.

It is always best, when possible, to apply power to a line shaft as near its centre as possible. Heavy drive pulleys should be placed close to the hangers, and the belts should lead in opposite directions as much as possible, in order to balance up those strains which tend to throw the shaft out of alignment.

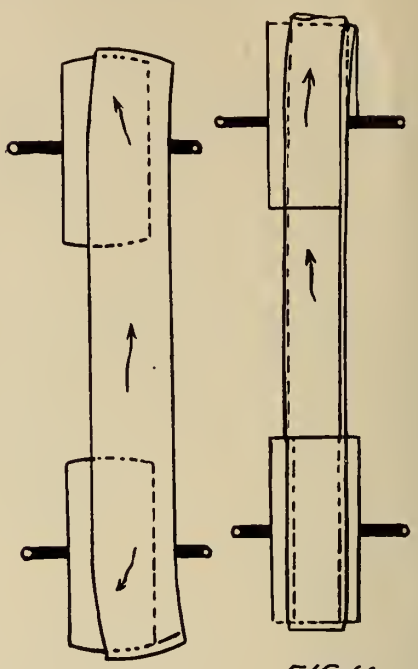


FIG13. FIG.14.

The following ratio is used in computing the speed of pulleys:

$$\frac{\text{Diameter of driver}}{\text{Diameter of driven}} = \frac{\text{Revolutions of driven}}{\text{Revolutions of driver}}$$

Take as an example Fig. 15. The pulleys (A, B, C and D) are, respectively, 40, 10, 60 and 8 inches in diameter, and the shafts make 100, 400 and 3,000 revolutions per minute. This constitutes a compound drive. But consider each drive separately. Assume (A) as the driver of the first pair, and (C) the driver of the second pair. (B) and (D) are driven. If (A) and its revolutions, and the diameter of (B) are given, required to find the revolutions of (B):

$$\frac{40}{10} = \frac{\text{revolutions of B}}{100}$$

$$\text{Revolutions of B} = 100 \times \frac{40}{10} = 400$$

If (D) must make 3,000 revolutions, and its diameter is assumed as 8 in.,

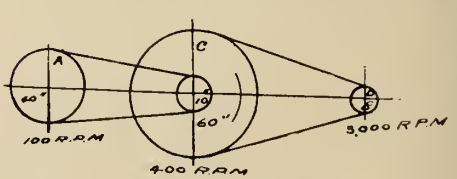


FIG. 15.

then to find the diameter of (C) we have:

$$\frac{\text{Dia. C.}}{8} = \frac{3000}{400}$$

$$\text{Dia. of C} = 8 \times \frac{3000}{400} = \frac{240}{4} = 60.$$

Milling Cutters : How They are Made, Used and Abused.

By John Edgar.

ARTICLE IV.

NOW that we have our cutter milled and so far along we may proceed to harden it. This is the most troublesome part of the job and a part about which very little can be said that will prove of help to those that may

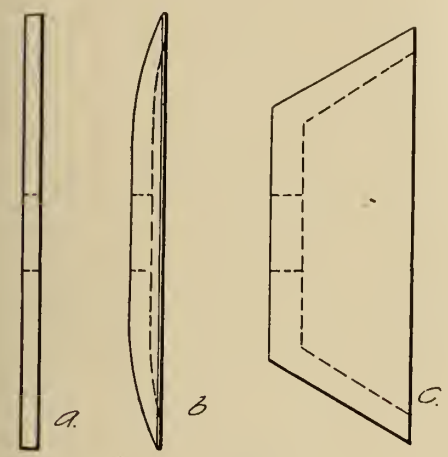


Fig 16.

wish to follow our advice. The best that can be done is to describe the methods in use.

Hardening and Tempering of Cutters.

The cutter is first heated to a red heat, the degree of heat depending on the grade of steel. The means of heating varies with the size of cutter. Small cutters are immersed in a lead bath in a crucible, only pure lead being used for this purpose. The larger cutters are heated in specially arranged furnaces, some of which are heated by gas, some by oil and others by coal or coke. The special grades of high speed steel require very high temperatures, and also require considerable skill in handling. The cutter after being heated is given a bath in oil and is then tempered in the usual way.

The Grinding of Cutters.

After the hardening and tempering process is completed we proceed with the grinding. The hole is first ground, and one end being faced at the same setting, the other end is ground by turning the cutter around. When this is done the teeth are ground over the tops to insure that they run true with the hole and ends. Then we proceed to sharpen the cutter teeth to fit them for the work they are to do.

Sharpening of Cutter Teeth.

There are several different styles of machines on the market which are especially adapted to use for this kind of work. The methods of operation are essentially the same, so that a general description of the method adopted on one style of machine will suffice.

There are several kinds of emery wheels, varying in grade and shape. There are three shapes that are extensively used in cutter grinding. These are shown in figure 16, (a) being termed a disk wheel, (b) a disk wheel, (c) a cup wheel.

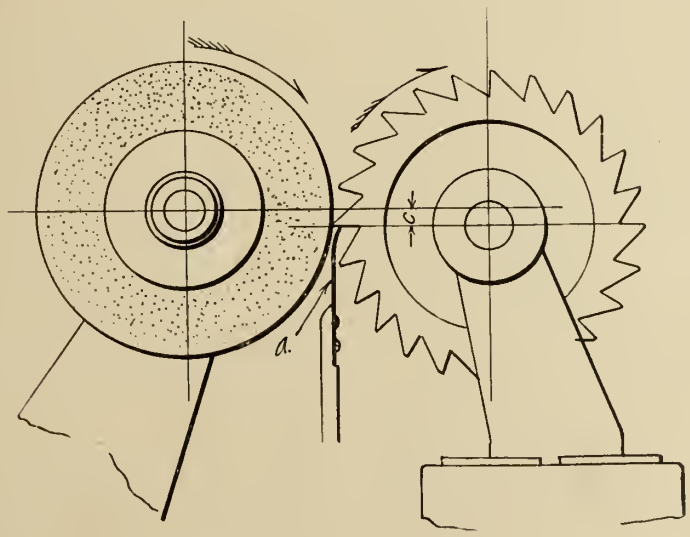


Fig 17.

Figure 17 shows an end view of a cutter and wheel in position for grinding the teeth on the periphery. The cutter rests on the finger (a) which gauges the clearance. When grinding mills with spiral teeth the finger is held stationary, the tooth sliding over it.

The wheel should be as large in diameter as possible in order to give as straight a back rake or clearance as possible ; if too small a wheel is used the tooth will be very slim at the cutting edge and will not be able to stand up to the work for any length of time. The effect of the diameter on the cutting edge is illustrated in figure 18, (a) being the shape produced by a cup wheel or a disk wheel used as in (a), figure 20. When the teeth are very fine and the cutter is comparatively large in diameter, the cup wheel may be used to grind the teeth. Some advocate the use of the cup wheel to the exclusion of all other forms, but present practice limits its use to the grinding of end teeth of end mills and side teeth of straddle mills. But this work may be done with the ordinary disk wheel. Figure 19 shows the cutter in position for grinding the side teeth with a cup wheel, and figure 20 shows how this would have to be accomplished with a disk wheel. The great difficulty with the cup wheel is that it presents so much surface that it glazes very rapidly, heating the work, and if care is not used the temper of the teeth will be drawn.

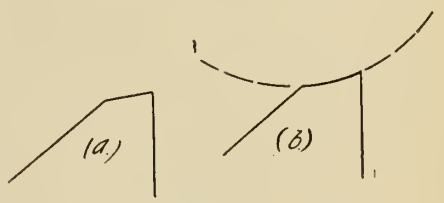


Fig 18.

Attention is here called to the direction of rotation of both the wheel and cutter, and to the position of the guide finger, figure 17. The finger should always be applied to the radial face of the cutter and the wheel should revolve in the direction which will have a tendency to hold the cutter against the finger. A divergence from this rule will endanger the operation, and should the cutter slip considerable damage to the cutter may result.

The motion of the cutter before the wheel is produced in two ways. First, in most machines the cutters are placed on an arbor whenever possible, or swung on centres when made on a shank, the centres being placed on a reciprocating table which is moved in a direction parallel to the face of the cutter ;

second, the cutter is placed on a stationary bar upon which it slides before the wheel. Obviously only those cutters which have holes are adapted to this

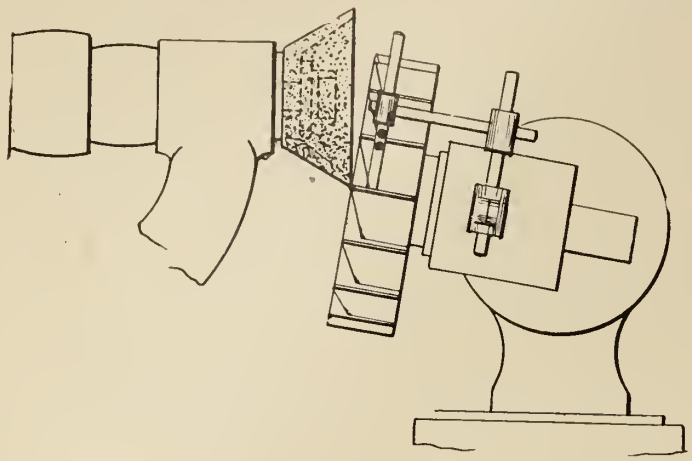


Fig 19

method. This latter method is the more sensitive of the two, and consequently the more expeditious. The bars upon which the cutters are made to slide are hardened and ground, and bushings are

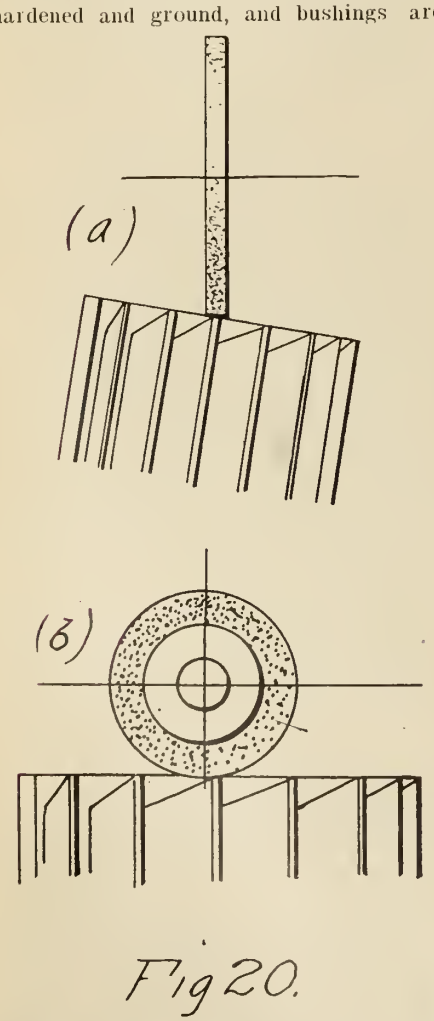


Fig 20.

made to fit different sized holes. These bushings are lapped out smooth and no oil is used on the bar. The bar should be provided with a special groove throughout its entire length, into which the emery dust may escape.

The disk wheel is used to sharpen formed cutters. The method used is shown in figure 21. The cutter rests on a bar and is moved back and forth past the wheel as shown. Very thin cutters, such as gear cutters, may be ground by placing them on a rest and feeding them in toward the wheel centre; but this method is not to be recommended since there is no assurance that the face will be ground radially, which must be done in order that the form of the tooth may be preserved. Care should also be taken that the rest is set parallel with the wheel centre, or else the face ground will not be at right angles to the sides of the cutter, which of course is necessary.

Speed and Choice of Wheels.

The choice of the wheel and the speed at which it should run vary with the circumstances. For cutter grinding the wheels should run at between 4,000 and 6,000 feet per minute, and a comparatively coarse grade of wheel should be used. Should too fine a grade be used it will fill up with chips and glaze over to such an extent that much difficulty will be experienced in the operation. The softer grades of wheels are more suited for grinding hardened steel. A wheel that fills up and glazes over will have a very great tendency to heat the work, which may occur to such an extent in some cases as to draw the temper.

Care of Wheels, and Feeding Work.

The wheels should be kept in good condition, and should be kept running true, which is accomplished by truing the wheel off with a dresser. These dressers are commonly made of disks, but the best results are obtained by using a diamond, the diamond being held in the end of a holder of convenient form. The cutting face should be kept as narrow as possible consistent with the strength of wheel, since a wide face has a greater tendency to heat the work than a narrow one.

The depth of a cut taken with a wheel should not be too great, as the pressure necessary to remove a very deep chip is excessive and is liable to spring the work, besides badly heating it.

In feeding the cutter before the wheel the feed should be held at the same rate for all the teeth as far as is possible, because if one tooth is fed past the wheel at a greater rate of speed than the others, the cutting face of this tooth will be at a greater distance from the centre, and will consequently remove more metal than the others, and very rough work will result.

Care of Cutters.

It is much more economical to keep the cutters sharp by repeated grinding than to leave them in a dull condition, because dull cutters wear very rapidly if kept in use. This is especially true in regard to formed cutters, because when the cutting edge becomes badly worn, the amount of clearance being so small, it is necessary to grind away a consid-

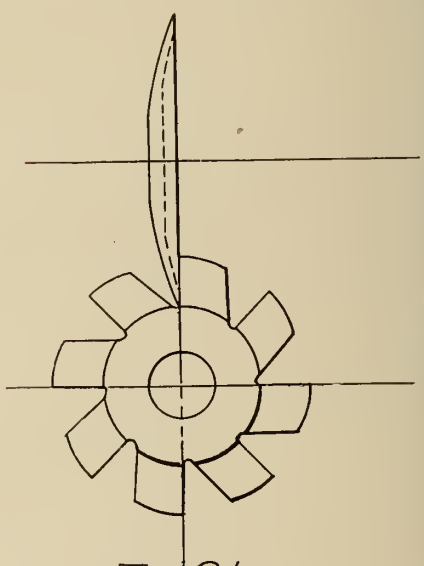


Fig 21.

erable portion of the face in order to restore the cutting edge. A cutter that is yet comparatively sharp requires very little grinding to sharpen it, and in this way the best results are obtained with the cutter.

There is probably no way in which a cutter is worn so much as in the practice of taking chips with very fine feeds, and chips so light that the cutter can not get under the surface to take hold of the metal, but has to grind off what it can, straining the arbor and machine far more than would a heavy chip, but to no productive purpose. I have mentioned this matter before to readers of Canadian Machinery, but cannot help emphasizing the fact at every opportunity.

Foundry Practice

MODERN IDEAS FOR THE TRADE.

UNIFORM PRACTICE IN FOUNDRY COST FINDING*

By Kenneth Falconer, Montreal, Que.

TO a certain extent I have accepted your secretary's kind invitation to submit a paper to this convention, and to meet in Cleveland the members of the American Foundrymen's Association under false pretenses, for I am neither an American nor a foundryman. These are misfortunes not faults, which I have to some degree overcome, inasmuch as I have the happiness of having an American wife, and the honor of belonging to the American Foundrymen's Association.

The saying that this is an age of "Specialism" is so common as hardly to be worthy of repetition : that it is an age of standardization of methods—of uniform practice—is equally true, though less frequently stated, and perhaps less generally recognized. The existence and growth of associations of those whose work is similar, or whose interests lie in the same direction is in itself an evidence of this : the logical influence of conventions and meetings of such organizations is towards the general adoption of certain principles, the details of their application being subject to individnal conditions and special requirements. As a result of this convention, different members of this association will, during the coming year, be thinking along similar lines, and adopting, in relation to certain features of their business, similar methods with similar ends in view. It may be possible that some degree of uniformity in cost finding methods in different foundries, and in different plants, whose interests are represented here, would result in general good to the trade. The Steel Founders Society of America have, in the recent past, taken up the subject of "Uniform Methods of Cost Finding for Steel Foundries," and those connected with each line of manufacture, or interested in each branch of industry might possibly consider with benefit the advisability of adopting in their different plants methods of cost finding uniform in so far as general principles are concerned, though possibly widely different in details.

*Read before American Foundrymen's Association, Cleveland, June, 1906.

It goes without saying that no system of cost finding can be designed for the manufacture of castings, or for any other business, applicable in all its details to the plants of competing concerns, but the fact remains that similar principles of cost finding, and the broad application of such principles on similar lines, are applicable in all plants manufacturing similar products, and the resulting influence will make for healthy and normal competition, instead of disastrous rivalry.

To standardize methods of costing and estimating in any industry, a clear understanding of the term "Costs" as applied to manufactured product is essential. To some it means only the value of material and labor consumed, to others it includes expenses incurred in running the plant, while the elect take it to cover in addition all expenses of selling and of administration, and in some cases all possible outlays.

While the division of each plant or organization into its component departments might involve in each instance different definitions of departments and limitations of authority, it would make for more intelligent estimating for competitive purposes, if competing plants were departmentalized in the first instance on similar general lines. All the departments of a productive organization are, naturally, capable of classification as manufacturing, selling or administration, this logically resulting in three costs, which may be defined as cost manufactured, cost sold and final cost. If all bids and tenders were based on accurate knowledge of these three costs, members of the trade interested would, to a greater extent than at present, have only fair and legitimate competition to meet. The methods of obtaining records of labor and material costs would necessarily be determined in each plant by the individual judgment of those in control, as would also all other details of cost work. Cost of material is practically governed by market conditions, and cost of labor too frequently regulated by forces beyond the control of the management, and there is, consequently, in these two factors but limited opportunity for cost reduction. In expense cost of product lies the greatest opportunity of effecting economies, and it is this factor of cost which should be thoroughly analyzed and closely watched so as to keep it down to the lowest possible figure. To do this, the amount of each expenditure going to form the aggregate expense cost of product should be known very promptly after the close of each period—week or month, as the case may be—and should be subject to constant comparison, not only with similar records of preceding expenditures, but also to items of related interest.

The basis on which manufacturing expenses are distributed on cost of product is a point regarding which, in Canada at least, there is little uniformity of practice amongst foundrymen. Some distribute such expenses according to the weight of output, some on the labor and material cost of product, some on the ratio of manufacturing expenses to the value of productive labor, and others again on the ratio of manufacturing expenses to the number of productive hours worked, irrespective of the wage price per hour. Competitive bids based on cost records secured by such widely different methods constitute unsatisfactory competition, are demoralizing to the trade interested, and are a strong influence towards creating unsatisfactory and unstable market conditions.

Uniform accounting methods are perhaps more important than would appear at first sight—not so much uniformity as between different plants as uniform methods to be used continuously in each plant. If a foundryman or manufacturer distributes his expenses during five different years according to the five different plans, previously mentioned, the value of his records of costs and results for those years is largely destroyed. This is not intended as an argument that present methods should be continued, simply because "we have always done it that way," it is meant as a plea for a very thorough consideration of the subject, and a determination in view of the conditions of each plant and business of what is the right and logical method of distributing expenses on product, of obtaining costs, and of carrying the results into the books.

MODERN FOUNDRY CONSTRUCTION *

By David Townsend, Pa.

I PRESUME there are still a great many old-fashioned foundries around the country districts to-day, but compressed air, electricity and the traveling crane have revolutionized foundry methods to such an extent that it is a very poor plant indeed that cannot show some advance towards the perfection which we all desire and think we know.

Let us consider for a short time the various points which are absolutely essential to a thoroughly modern shop. Where a new foundry building is under consideration and its size or capacity has been fixed upon, the other essential parts are: Materials of construction, movements of production, storage of raw and finished materials, light, power and heat.

Taking it for granted that there are no complications, as to size or location of site, the first thing to be considered is proposed amount and kind of output and the floor space which it will occupy. This ranges all the way from 5 to 15 pounds per day of 10 hours for each square foot of actual molding space occupied, according to the product to be made. This, of course, does not include any core room, core oven or cupola space.

Strange as it may seem, the heavier the work, the less pounds output per square foot per day can be produced, because on large pieces molded in the floor, such as engine beds, lathe beds, etc., a long time is taken to mold and prepare for pouring, and to subsequently cool, and, although the weight may be considerable, the average in pounds per foot per day is very small. The largest output is obtained by molding machines and snap flask work, where continuous or multiple pouring is practiced, and the molder does nothing but mold, his heat being poured off almost as made, by an expert gang of men who do nothing else.

* A paper read before the Philadelphia Foundry Foremen.

The class of work to be made and the daily output having been determined, the size of building and materials of construction are the next important items to consider, and here is where the question of cost first appears as an important factor. We all naturally want the very best for the least money, but when the range of cost runs from 80 cents per square foot of floor space covered up to $1.50 per square foot, there is considerable room for a choice. At one end of this range we have the old brick or skeleton iron frame structure with wooden sides and roof, and at the other, an absolutely fire proof structure made of steel and concrete throughout.

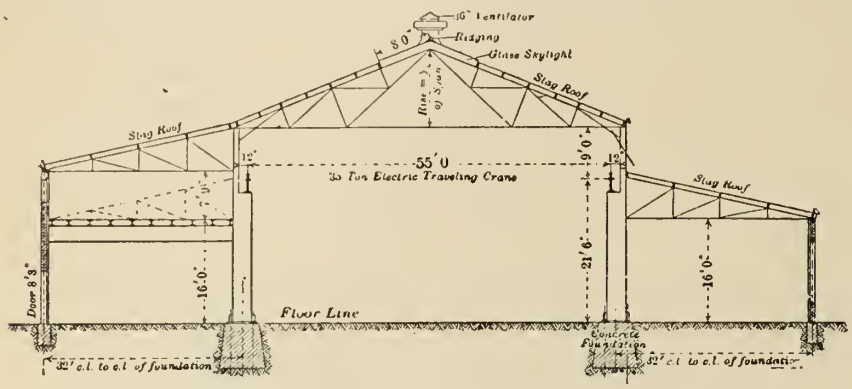


FIG. 1.—CROSS SECTION OF STEEL FRAME FOUNDRY BUILDING.

I have developed in my own practice a construction which is practically fireproof, except the roof, and have had an experience with the same from the insurance standpoint; the worst that happened being a partial destruction of the roof and all of the glass skylight which was cracked by the heat. This fire was caused by the exploding of a mold for a 30-ton anvil block, which shot several tons of liquid iron against the underside of the roof and caused a fire which damaged the glass principally as stated.

My construction consists primarily of a steel frame, self-contained structure with nine-inch brick or four-inch concrete curtain walls, ordinary glazed sash, and a steel truss with a wood roof covered with four-ply slag and containing glass skylights its whole length. A cross section through the building is shown in Fig. 1.

This construction is being generally adopted for iron foundries in this country, and, of course, has many advantages and some disadvantages; the latter connected principally with the subject of storage and movement of raw materials and general arrangement of storage yard for iron and fuel.

The arrangement most favored in Europe is one which has the cupolas, furnaces, core rooms and sand storage in the centre of the building as shown in Fig. 2. This style of construction has also been adopted very largely in this country for steel foundries. In these plants, one whole side or floor is used for molding; the molds then being put into the core ovens and when dried are taken out on the other side onto the casting and cleaning floor. The core ovens are in the centre bay and a very large sand storage space is obtained by utilizing the top of them for bins. This brings the new sand inside the foundry and in a position where it can be utilized for tempering or for new molds, without handling. In steel foundries, the furnaces are put on the outside of the general foundry construction, but where this type is used for iron foundries, the cupolas are placed in the centre bay with spouts to deliver iron into either side and the space over the core ovens, core rooms, store room, etc., can be used for storage of sand, coke and iron.

Aside from a proper selection of materials for construction and general arrangement, the most important thing to be provided is good light. We have all suffered in various degrees from the want of good light, and know the inconvenience of always having a hot, smoking oil lamp under our noses to see into dark corners of the mold.

To my mind no other item about a foundry will give the financial return that is to be had from a strong natural light. Aside from the fact that daylight costs nothing and artificial light of any kind is expensive, the cheerfulness of disposition and general temper of a shop are very much improved by proper natural illumination.

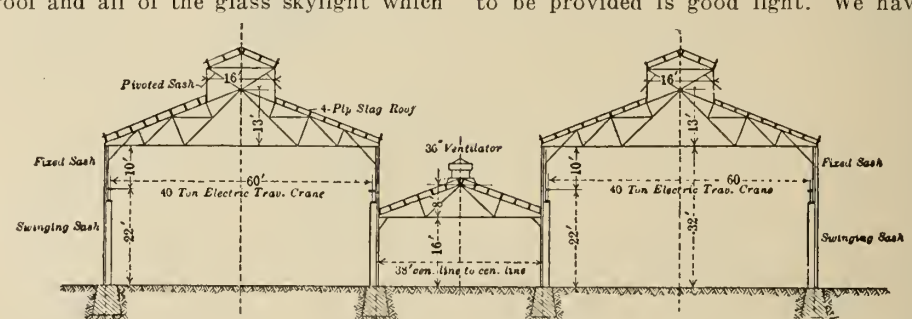


FIG. 2.—CROSS SECTION OF FOUNDRY BUILDING USED IN EUROPEAN PRACTICE.

MANUFACTURE OF SOIL PIPE AND FITTINGS

Paper Prepared for the Recent Convention of the American Foundrymen's Association by T. J. Best, Montreal.

THE first requisite in the art of making soil pipes and fittings is a well lighted and ventilated foundry. A shop 86x200 feet will be required for a melt of from 20 to 25 tons per day. Light should come from each side and end, also from one or two monitors running nearly the full length of the roof, with pivoted sash duly placed in them. This will make the centre of the shop nearly as light as at the sides. Perfect ventilation will also be assured. The mill, or cleaning, chipping, and oiling rooms, should be at one end of the foundry, separated by a fireproof wall. The mill room should be large enough for 12 to 16 ordinary mills. If, however, exhaust mills are used, a smaller number will answer.

The Method of Molding.

In the centre portions of the pipe floors, at proper distances apart from each other, there should be set and secured firmly iron rails or small I beams, on which to rest mold boxes and machines. In the centre of the passage between floors tee irons should be suspended from the roof, well stayed, and high enough to allow men to walk beneath them. This is for the purpose of resting the mold boxes against them while on end, after the heat has been poured and the boxes shaken out at night. A good supply of trucks is essential to carry out the castings either by night or day, as may be desired. In any case a few men with good trucks can clean up the foundry very quickly.

The machines or follow boards, on which the pipes are made, as well as sizes and weights of mold boxes, vary in different establishments. Some foundries use machines run by steam, others use hydraulic power or compressed air, to press the mold. The general way, however, is to do the work by hand ramming. The pattern should be made very accurately and be well fitted. I have seen patterns made with rather more than half circle and finished with files and emery cloth. This is a tedious and crude way. By all means see that good sound castings are provided, and turn them up. If you have a universal grinder, finish your patterns by grinding them. Too much care cannot be given the machines and patterns. The plates and stops for mold boxes must be accurate. The mechanism for raising and lowering patterns should be as simple as possible, with the precaution that the patterns should be raised vertically only. I have seen cam motions that would lift patterns slightly sidewise, while others would lift toward one end. This is liable to make an overlap one way or the other. Patterns for 2-inch and 3-inch pipe are made two in a box. In many places the 4-inch are also made two in a box, but with a single pattern and a light box one man can make 35 and in many cases 45 4-inch pipes a day, if two men are working together. Another advantage is that when one man rams the mold it will be uniform. Two men working on a mold will not ram up the same, and the result is an uneven casting. Good results are obtained with one man on a floor and the understanding that the men lift for each other, and also help set the cores.

The light pipes should be made in the centre of the shop, so that the hottest iron may be poured there. The heavier material can be cast at the ends of the foundry, and the metal taken there in small bull ladles holding 500 to 600 pounds, on an overhead system. This will save a lot of hard work. The fitting floors can all be stationed at one side of the foundry, or in any other part not taken up by pipe floors.

Better Pipe and Fittings Demanded.

We have to turn out a better grade of pipe and fittings than formerly. I do not know how it is with you in the United States, but we in Canada are forbidden to use the broad mantle of charity that covers a multitude of sins —that is to say, the hot tar pot. Our pipes and fittings must be oiled, or dipped into a mixture of oil and benzine. The oiling room should have two or more tanks in which all pipes and fittings can be immersed; also suitable drainage racks on which pipes can be stood on end, the surplus oil running back into the tanks. The fittings are dipped and thrown on a drainage rack. Racks about 2 feet apart and as long as convenient may be set up, bars of ¾-inch pipe being placed about every 2 feet to form pockets or divisions. This will prevent the oiled pipe from falling over, and by the time the rack is filled the first pipes will be ready to go to the shipping room. Some foundries dip their pipes on the side, while others dip on end. This may be carried out just as is desired or convenient.

Pipe Cores.

There are various ways of making cores. They are now, however, usually made of green sand. Some foundries do their ramming by hand, others by means of squeezers, and still others in vertical core boxes made in three parts. In the boxes the back part is held stationary and the other two parts are hinged to it. The core bar is whetted and put into position. Then a tube, having a screw with a coarse thread at the lower end, is lowered over the core bar, a small quantity of sand thrown in and the screw revolved by machinery. A man throws the sand into the hopper and as the screw revolves it packs the core, which raises itself at the same time. There are balance weights on a chain which regulate the pressure put on the sand in the box. This machine is very good, but also very expensive, and is being superseded by the horizontal machine. There is a great variety of these machines. For instance, I have seen a long riddle suspended so as to sift the sand down on a core bar. The noise of the mechanism could be heard a long way off and was very annoying. Others are made with a shaft on which a number of wheels are made to revolve and thus shake the sand on the bars. Whatever the style, the bar revolves and the sand falls on it from above. As the sand impinges it is rotated against the steel knife provided and shaped for the purpose. From 500 to 600 cores can be made and used each day on a good machine, in sizes from 2 to 6 inches in diameter. The change from one size to another can be made in a minute.

Cupola and Melting.

We read so much about high and low melting ratios. The trouble is that we do not take time to think deeply enough about our business. For instance, not long ago I read of a foundry having a 52-inch cupola melting about 20,000 pounds a day at a ratio of 6 to 1. They could not understand why others were getting better results. I do not pretend to know as much about what I have given here as I ought to, yet I do say that if we want to be successful we must proportion things properly. Therefore for a plant such as I have described in this paper, in which from 20 to 25 tons a day are cast, the cupola should measure about 45 inches inside the lining, which should be double brick. At least six tuyeres 4 by 12 inches should be arranged for. The main blast pipe should be 18 inches diameter, and if convenient let down each side of the cupola in two 13-inch pipes. The blower, which I prefer to have a positive one, should be as near the cupola as convenient. In this way from 3,500 to 4,000 cubic feet of air will be furnished each ton of iron melted and there will be no difficulty in getting a 10 to 1 ratio. It must be borne in mind, however, that it is as important to look after the coke as any other part of the melting scheme, and suitable dry sheds should be provided for it as well as the sand.

For pipe and fittings the metal required should be both hot and clean. In order to have this let the melt be as continuous as possible.

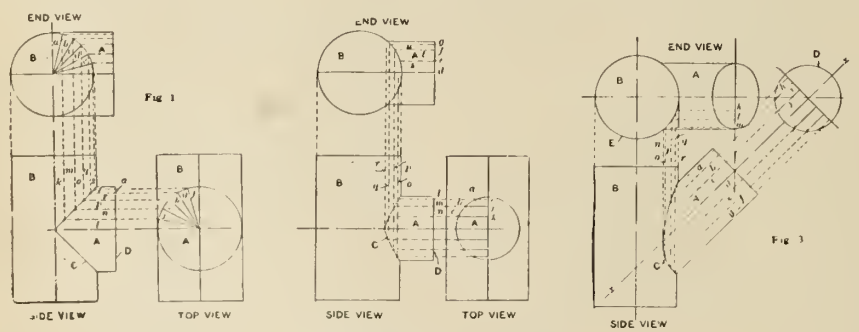
Mechanical Reviews

OPINIONS AND STUDIES WORTH NOTING

FITTING CURVED WORK.

ANYONE having but a limited knowledge of drafting can do this little trick very easy and after a little practice find it a time saver, doing away with a lot of guessing, superfluous cutting and the dulling of tools.

Fig. 1 is a tee, (B) is the main body and (A) is the piece to be fitted thereon. The object is to mark (A) to be cut where it joins (B). To do this accurately the following method will be found practical. Let us suppose there is a full size drawing of this at hand. Lay a piece of tracing paper on the drawing. Trace the outline of the three views, step off the divisions and project lines as further directed. Or the patternmaker can prepare a drawing, three views will be necessary. One quarter of the circle of (B) in the end view is divided off into any number of equal divisions, (a, b, c, d, and e). A quarter of the top view is similarly divided off as at (f, g, h, i, and j). From the points of these divisions lines are projected on to the side view, as shown by the dotted line (k, l, m, n, o, p), etc., and where these lines meet, as denoted by the dotes, is in each case a point in the line of junction of the two cylinders (A) and (B).



The Fitting of Curved Wood.

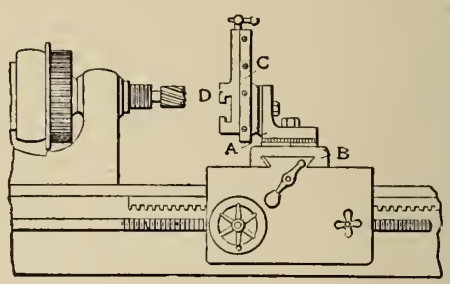
Next take the cylinder (A) and step off as many points on its circumference at (f, g, h, i, j) as there are on (B). It must be stated that the more points you step off the more points you will have in the curve at the junction (C). Draw parallel lines (t, r, p, n and l) from end to end as in the side view. Mark the distance beginning at (a) to dot which is line (t), then line (r, p, n, l) from line (D) and you have points on Cylinder (A) giving the correct curve, which can, if (A) is of large diameter, be cut out with a compass-saw, providing it is staved up in the usual manner, and then trimmed to a perfect joint with a spoke shave.

Fig. 2 represents a tee in which (A) is of less diameter than (B), hence the two join in a curve, which is found somewhat differently than is the case in Fig. 1. First the three views are drawn in outline as before. The top view is stepped off as shown at (a, b, c) and lines (i, j, k) drawn. The length of line (i) is taken with the dividers and with (d) as a centre transferred to (e) in the end view, (j) and (k) are taken the same way, and from these points lines are projected on (A) as shown at (s, t, u) and where they intersect with the circle of (B) is the point to drop (o, p, q, r) down to the side view. Where they meet (1, m, n) are the points in the curve at the junction of (A) and (B) as shown at (C). Part of pattern (A) is divided as in Fig. 1 and the parallel lines drawn on the surface. Then the lengths of these lines are measured from line (D) to the dots, the curve drawn and it is ready to be cut.

Fig. 3 shows the part (A) at an angle of 45 degrees. The end and side views are drawn and the circle (D) is drawn on centre line (x x). Half of this circle (D) is stepped off equally and from the points of division lines are projected to (A) in the side view as at (a, b, e, d, e, f, g). The lengths of lines (h, i, j) are transferred to the end view at (k, l, m) and projected to circle (E), in the end view, and from their junction on circle (E) drop lines to side view as at (n, o, p, q, r). When these lines meet (a, b, e, d, e, f, g) are points of the curve at the junction of (A) and (B) and the curve (C) is easily drawn through the points of intercection. The intersecting parts of (A) are treated the same as in Figs. 1 and 2. If everything has been laid out as directed a perfect fit is secured.—Wood Craft.

MILLING IN THE LATHE.

SOME years ago, having occasion to do quite a little light, plain milling in a shop whose principal "equipment" consisted of one good 1-4 inch lathe, with compound rest, I got up the rig shown in the enclosed sketch. This



Cheap Milling Device for Lathe.

rig is so simple and obvious that it hardly seems possible that it can be new; yet I have never run across it in my travels, and have several times turned in the suggestion in small shops where there was no miller, and it has always been warmly welcomed and given good service on light work.

Its cardinal virtue is its cheapness and simplicity, for aside from the vise, which may often be on hand, the whole cost for any lathe having a compound rest should not exceed five dollars. Another point in its favor over some of the clumsy lathe-milling makeshifts I have seen, is the quickness with which it can be set up and removed without in any way interfering with the regular uses of the lathe.

All there is to it is to get out a pattern for an angle casting (B), both faces of which are circular, the distance from the base to the centre of the vertical face being the height from the top of the graduated circle (tool-block bearing) on the cross-slide to the centre of the lathe spindle. The diameter of the faces on the angle piece should be the same as the inside of the graduated circle on the slide for the bottom face and about 1-2 inch greater for the vertical face, in order that the latter may be chamfered for about 1-4 inch and marked off in degrees if desired. After both faces are

turned up bolt it to the cross-slide (B) in place of the usual tool-post block, with the vertical face accurately at right angles to the lathe ways, and make a setting mark to correspond with zero on the graduated circle. This should be carefully done that future settings may be quickly and positively made. The compound rest (C) is now bolted to the vertical face, as shown, and a light cut taken—with an end-mill in lathe spindle—across tool-post seat to insure truth, using the cross-feed of the lathe and feeding down at the end of each cut with the compound rest screw until the whole face has been gone over. Any small machine vise may now be bolted to the tool-post seat (D), after which the compound rest should be carefully set, in its new position, so that the travel is exactly vertical and zero marks made for resetting.

It is surprising what a range of light work may be done with this simple rig, an end-mill or two fitting the lathe spindle, and a few cutters to run on an arbor between centres. Longitudinal and cross feeds are provided by the lathe carriage, and vertical feed by the compound rest, while horizontal angular adjustments are gotten by swiveling the angle block on the carriage, and vertical ones by swiveling the compound rest on the block. Naturally, it is not intended for heavy work, but it is something more than a makeshift, and on very light work it is sometimes even handier than a miller, while on experimental and die work it is almost invaluable in a shop without a regular milling machine. In using end mills the base is swiveled at right angles to the lathe bed, as shown, while with cutters on centres it is, of course, swung parallel with bed.

Both cross and longitudinal feeds, geared as fine as possible, may be used if needed, and both screws may be used for indexing; or perhaps it would be more proper to say dividing. With a little ingenuity its applications are quite varied. I once cut several small sections of rack, using a cutter between centres and indexing by the lead screw, and at another time did a very good job of drilling and reaming on some small plates with rows of 1-8 inch holes requiring accurate spacing and perfect alinement. A bushing held in the centre rest served to steady the point of the drill and start the reamer fair. In this case I used the cross-feed screw, with a micrometer collar for indexing. The lathe was new and the screw was not worn, and the results were entirely satisfactory. There were several of these plates to do, and as they had to be right, the cost of the rig was saved on this one job alone.—M. C. Conwell, in American Machinist.

BANKING A CUPOLA.

BANKING a cupola is so unusual an occurance that a history of the incident, as it occurred with us recently, may perhaps be read with interest and the details of the experience may include information of value to some of your readers.

To a foundry man, the labor, loss, danger and annoyance incident to dropping the cupola bottom, particularly when the cupola is pretty well loaded, are too familiar to require rehearsing here, and they were what determined us to stop the machinery and to take our chances on banking the cupola and running heat off next morning after the necessary repairs would have been made.

Our outfit in operation was a No. 9 Whiting cupola lined down to 58 inches. The bottom of tuyeres 12 inches above bottom, lower tuyeres only in use. No. 5 Baker positive pressure blower supplied blast varying in pressure from four to seven ounces.

This pressure being insufficient for proper melting of iron, at the rate desired, a No. 9 Sturtevant fan was installed. It so happened that the position of the Baker blower was near the foundation fot the new blower, so that a length of pipe made to run from the Baker to a point where the mouth of the new fan was to come made a return to the use of the old blower possible by the removal of the new blower from its foundation and the placing of the above mentioned pipe.

The way matters arranged themselves there was no time to test out the new installation before time to start blast. In starting the precaution was taken to keep the blast gate closed so as not to fan up the fire.

Trouble came with the start and five-thirty came around and the machinery was still out of order. Upon consultation it was determined to bank the cupola.

The cupola was charged with 2,200 pounhs of coke on bed and filled to the doors 17 feet up. The fire having been lighted at 11.55 in the morning and the banking was begun at 5.30, the cupola had been five hours and thirty minutes under draft.

The men were sent home and told to report at seven in the morning. The banking was accomplished by filling in the tuyeres with fresh coke further with rags and pounded tight with molding sand.

The top was packed in the same way with rags and molding sand forming a cover about six inches thick.

While the cupola was being banked the fan was removed and pipe connected to the old blower.

In the morning tuyeres and top were cleaned off and blast put on at 7.30, the first iron appearing fifteen minutes later. The first two hundred pounds were used for drying ladles, the next two hundred pounds for pouring grates and after that the iron ran white hot throughout the heat.

Hoping this recital may enable others to encounter a similar difficulty with more confidence than we could feel with this, our first, experience.—The Foundry.

PRACTICAL DATA ON SUCTION GAS PRODUCERS.

SOME experiments were recently carried out at Glasgow, with a view of demonstrating the practical qualities of the suction gas producer, especially as regards continuous running at full and light loads, says a writer in the Engineer. Six sets of plant were exhibited, of which four were fully tested, of about 20 brake horse-power and four of 8 brake horse-power. The following are the average data of the first six: Cost of gas plant, $420 (from $350 to $500); weight of plant, 3,400 lbs. (2,800 to 5,000); cost of engine, $600 ($530 to $630); weight of engine, 7,200 lbs. (5,800 to 8,400); speed, 205 revolutions a minute (190 to 220); total floor space occupied, 224½ square feet (144 to 288).

It will be seen that the variations were wide, except in the cost and speed of the engines. It was found that 15 minutes sufficed to get up a full working load from cold.

The four large sets tested for 8 or 10 hours gave the following results: Mean effective pressure, 78 lbs. to square inch; mechanical efficiency, 84 per cent.; coal per brake horse-power, 0.83 lb. at full load. The corresponding figures at half load were 78 lbs. to square inch., 71.2 per cent. and 0.98 lb.

In the case of the 8 brake horse-power sets, the average cost of the gas plant was $316; weight, 2,130 lbs.; cost of engine, $390; weight, 3,750 lbs.; speed, 220 to 230 revolutions per minute, and the total space occupied, 208 square feet. Running on full load for 10 hours, three of these gave a mean effective pressure of 79.1 lbs. to square inch; mechanical efficiency, 81.4 per cent.; and coal consumption a brake horse-power hour, 1.10 lbs. On half load the figures were 77.7 lbs., 69 per cent. and 1.11 lbs. of coal.

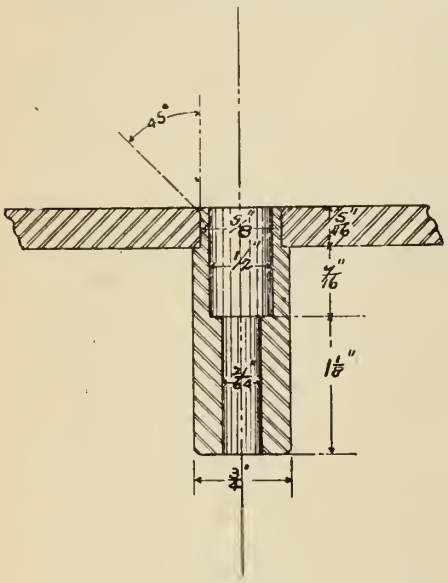
By the committee in charge of the tests the results were considered highly satisfactory. The cost of fuel a brake horse-power was about 0.1 per cent., a remarkably low figure, but to this, of course, must be added the cost of interest and depreciation and labor.—Gas Power.

Tricks of the Trade.

Everybody is invited to contribute to this page. Send in your ideas, odd jobs you are doing, and anything of interest to fellow-workmen. Remuneration will be made for such contributions. [Ed.]

PUNCH AND DIE STRIPPERS.

ONE of the principal operations of a combination punch and die is the methods and means for stripping the scrap and punching readily from the punch and die, and at the same time be able to adjust the throw and stripper without disturbing the setting of the die. It will be readily seen from the sketch that the punch may be placed in



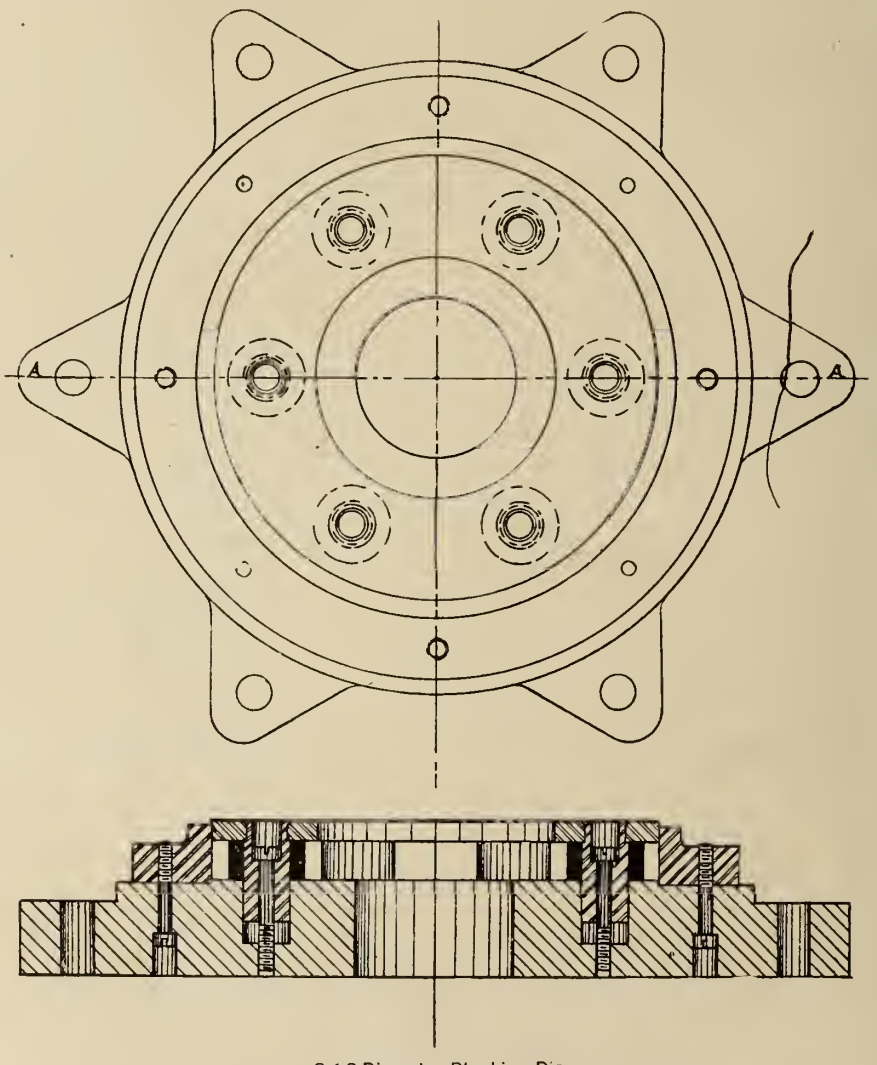
Details of Guide.

the die and be supported by parallel the required distance in the die, and placed in the press and set. The throw-out is dropped in and screwed down, and then the stripper is placed over the punch and screwed up until its face exceeds that of the punch 3-32 in. or 1-16 in. at least. We use a ratchet screwdriver for putting in the screws, but a bent screwdriver will give the same result. It will be found that it is easier to set the die and that there is practically no danger of having large combination dies injured through setting. If the stroke of the press is too small to allow the throw-out, and stripper room to get in, the throw-out may be screwed down below the cutting edge of the die, and the punch stripper screwed up the same way, then the punch is placed in the die resting on the throw-out. After the die is set the throw-out and stripper are adjusted to their proper height above the cutting edge of the punch and die. The sketch shows a view at (Á A) showing a detailed view of the guides with the rubber in position. It will be readily seen that so soon as the punch strikes the throw-out it presses it down into the die, it sliding over the screws which remain stationary in the die block, while the same motion takes place with the punch stripper. Springs may be employed in place of rubber with the same result. The guide is made from cold-rolled steel, and has 1-64 in. clearance in the hole.

F. LAUER, Toronto.

EQUIPMENT FOR MACHINE TOOLS.

THE writer has been interested in the many various suggestions which have appeared in your paper pertaining to the rapid and economical methods of machining different pieces of work, which are to be put through in large quantities. All modern shop managers recognize the importance, in fact, the necessity, of using special jigs, tools and fixtures for this work. One reading the various mechanical papers, and not fully acquainted with shop practice, might come to the conclusion from the numerous special tools described therein, that nearly all machineshop work is now done in this manner. While this is the case to a very great extent, it is probably not an exaggeration to say that nine-tenths of the work done, even in those shops which are turning out duplicate pieces, such as engines, electrical machinery, etc., is still being done in the old-fashioned way of clamping each piece separately in the machine and machining it to the size with a single cutting tool, no special clamp fixtures being practical for the greater part of this work. It is, therefore, essential that every accessory which can be added to these machines to facilitate the rapid clamping of this work should be supplied.



8 1-2 Diameter-Blanking-Die.

It is, however, a fact very noticeable to every one who has had experience,

that in most of our manufacturing plants these very necessary appliances are lacking. The average superintendent is keenly alive to the possibilities of the use of our rapid cutting or high speed steels, but there is just as much to be gained by the rapid clamping, progressive of our large manufacturing establishments this feature is receiving its full share of attention, and herewith are produced some illustrations which were taken in one of our large electrical works, where the matter has been gone into thoroughly, and every

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Book 3
Page 22
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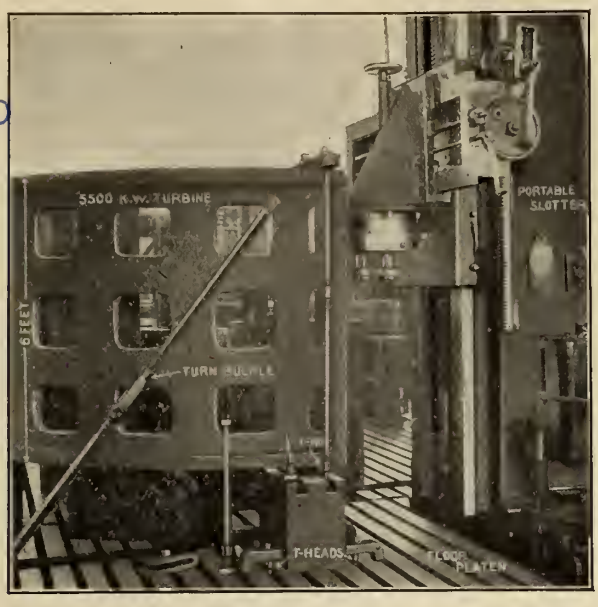

FIG. 1—Floor Platen.

setting and getting ready to do a job, as there is doing it after the machine is started. There is, perhaps, nothing which so discourages the operator of a machine tool, who really wants to turn out all the work possible, as, when setting up his work, not to be able to find the proper bolts, clamps, washers, nuts, wrenches, clutch jaws, drivers, dogs, etc. These seem such small and unimportant items that they really receive little or no attention from the foreman, in spite of the fact that they are absolutely necessary to the rapid turning out of work. It is, however, encouraging to note that among the more convenience which tends to make the work easier is supplied. As will be noticed, there is possibly nothing new about any of these tools, except that they are supplied in proper quantities and kept at each machine in a box by themselves.

Illustration No. 1 represents a large floor platen, upon which the large work is clamped, and portable machines, electrically driven, are brought to the work to do the different operations of slotting, milling, drilling, etc. It will be noticed that there is not any wood used on any of these machines. Long turn-buckles with forked ends are used for bracing or driving, and these can be bought all ready for use, except that the ends must be split. Illustration No. 2, of the boring mill, shows a handy device for blocking under the outer end of clamp. These heel blocks are about 6 in. by 6 in. by 2 in. wide, $\frac{3}{8}$ in. thick of metal, and, as can readily be seen, they can be used on work 2 in., 4 in. and 6 in., and by putting two together, as shown in cut, 8 in. high. By adding a third block on top of the second they can step on up indefinitely. This does away with wood and makes a much more rigid block. Illustration No. 3 of the rotary planer illustrates very clearly the T-heads, which are used throughout the shop in place of bolts. These T-heads are tapped to receive studs. From one to two dozen of the heads are placed at each machine. It is then an easy matter to make studs in the bolt cutter of all different lengths to screw into them, these T-heads being so shaped as not to require the cleaning of slots after each job. They can be placed anywhere desired after the work is set on the machine. The ease and rapidity with which the studs can be made insures a plentiful supply always being on hand when desired. It has been found through actual experience that the adoption of these fixtures has increased the output almost as much as did the use of the high-speed steels, and I believe the time is not far distant when every successful machine shop will have to give more attention to these really cheap, but altogether indispensable tools, not only on account of the increased output which it means to the shop, but because these conveniences will be appreciated by the mechanic more than any other improvement which can be put in at even far greater expense.

GEO. R. LANG.

Meadville, Pa.

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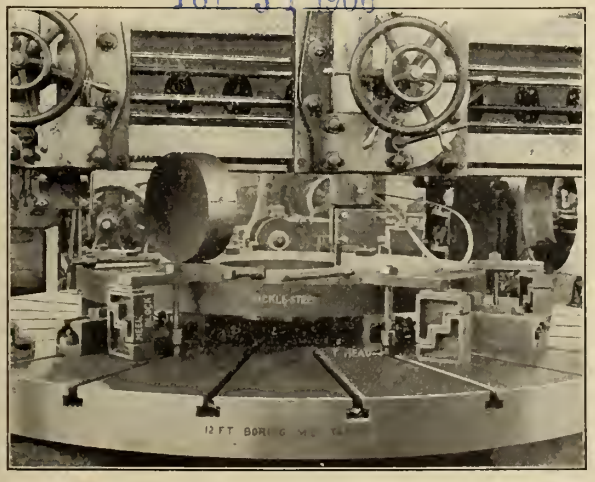

FIG. 2—Boring Mill.

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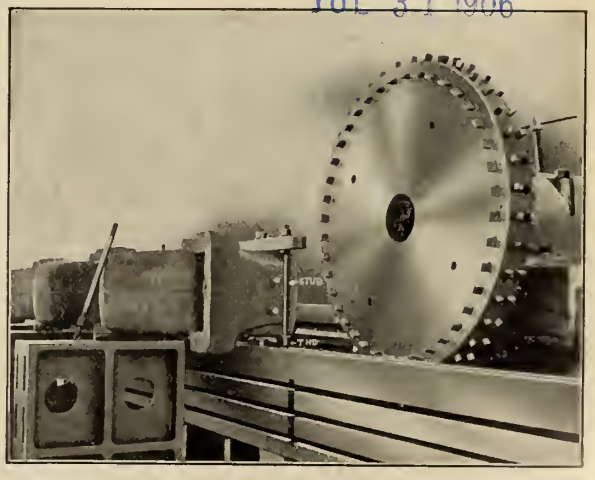

FIG. 3—Rotary Planer.

Power and Transmission

Steam Gas Electricity Compressed Air Water

CANADIAN BUFFALO FORGE TURBINE PUMPS.

IN the July issue of Canadian Machinery was given a complete description of the construction of the new turbine pumps with balanced impellers, to be manufactured in Canada by the Canadian Buffalo Forge Co., Montreal. The operation and efficiency of these pumps as demonstrated in two tests made by the Buffalo Steam Pump Co., the originators of the turbine pumps, will be of interest.

The makers claim that these pumps have been built successfully for very high heads, even in sizes heretofore thought too small for high head work. Pumps in capacities of 400 gals. per minute, and even less, have been operated economically against heads as high as 1,500 ft. Fig. 1 shows an eight-stage pump of capacity of 300 gals. per minute against 1,400 ft. head. This pump, however, really consists of two four-stage pumps in series as shown.

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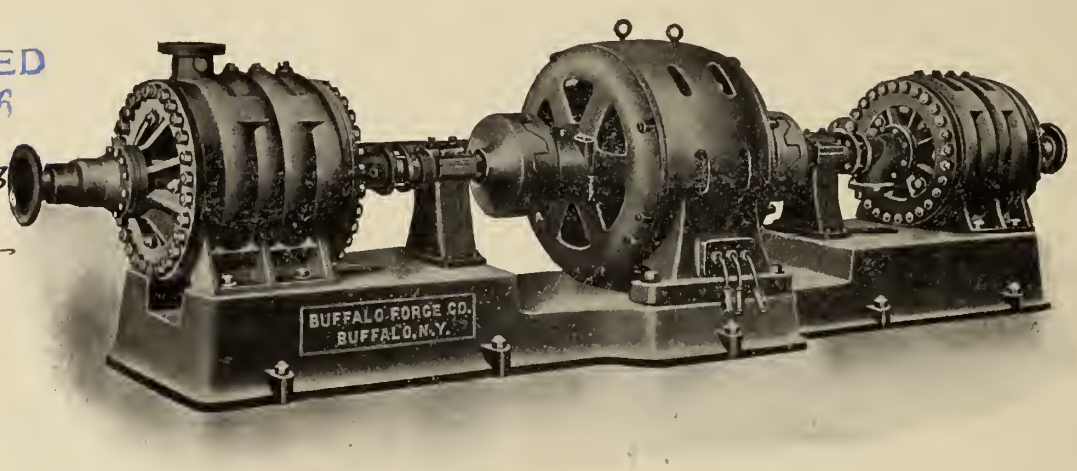

FIG. 1—Eight-Stage Buffalo Turbine Pump.

The results of the two tests made are shown in Figs. 2 and 3. The curves of Fig. 2 refer to a four-stage turbine pump designed to discharge 250 gals. per min. against a head of 630 ft. As the curves show, the specified delivery corresponds very closely both to the point of most efficient working and to the desired delivery-head. The efficiency under this condition is nearly 73 per cent. The pump works at more than 70 per cent. efficiency over the range from 185 to 310 gals. per min. discharge, corresponding to a variation of 90 ft. in head. That is to say, a total variation in head of 14 per cent. of normal produces a variation in discharge amounting to 46 per cent. of normal, with practically the maximum efficiency throughout this range.

An efficiency only slightly lower than that of the preceding pump was shown by a pump tested with the results shown in Fig. 3. The maximum efficiency, 71 per cent., was obtained at a discharge of about 1,000 gals. per min. against 40 ft. head. An efficiency of 70 per cent. or over is maintained through the range from 875 to 1,050 gals. per min., corresponding to a variation of 4.5 ft. in head. In this pump, therefore, a variation in the delivery head by 11 per cent. (of normal) varies the discharge by 17.5 per cent. of normal, while maintaining full efficiency. The latter pump thus has a steeper head-delivery characteristic than that of Fig. 6, although the scales used make it appear that the former has the steeper characteristic. The pump of Fig. 3 is much more nearly a constant-power machine than the other, which is corroborated by the power curves.

The fact that turbine pumps can be designed to have characteristic curves of any desired shape (within limits) is a very important element in their adaptability to different classes of work. For example, a pump intended for certain kinds of drainage work might be required to show a large increase in discharge for a small decrease in head, so as to keep the water at a nearly constant level. This result calls for a very flat head-delivery characteristic. Another pump might be required to have a practically constant load, for example, the full capacity of the driving motor. Such a pump would require its discharge to vary about inversely as the head, giving a characteristic quite different from that of the other case. Most such requirements can be met by careful design coupled with experience in the performance of completed pumps.

The shape of the impeller blade curves is the principal variable. Its relation to the performance of the pump is summarized in a general way by the makers in the following statement:

"The usual design of impeller has the blades turned away from the direction of rotation at a sharp angle, for the reason that this design allows a larger range of head and capacity with less falling off in efficiency. In frequent cases, however, the blades are radial as they approach the periphery of the impeller, or they may even be turned forward in the direction of rotation. This is common in the design of a pump the speed of which is limited by the engine or motor direct-connected to it. Generally speaking, the backward-turned blades are to be used wherever there is danger of overloading the motor by a

decrease in head, and the radial or forward-turned impeller to obtain a greater head at a given speed, or for service which requires the head to be kept up to the normal through a considerable variation in the water quantity delivered, as for city water supply, boiler feeding or condenser circulating pumps. To a certain extent, however, any of these impellers may be so designed as to prevent serious overloading through a considerable range in head."

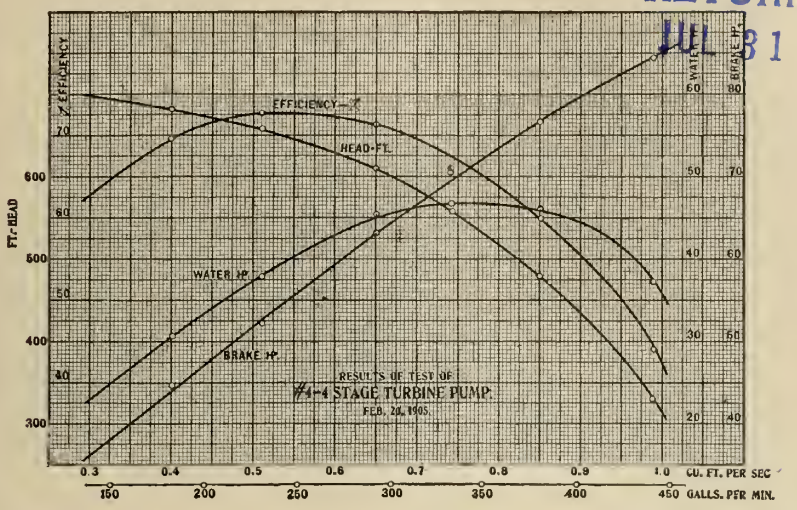

FIG. 2—Curves of Results of Tests on Four-Stage Buffalo Turbine Pump.

These pumps are made in a large range of sizes, 4-in. to 15-in. regular, with corresponding capacities, at a velocity-flow of 10 ft. per sec., of 390 to 5,500 gals. per min., and they are built in larger sizes to order.

These pumps are built single-stage or multi-stage. When built single-stage a double impeller is usually used and a double suction pipe, thereby giving complete balance as regards axial thrust; this refers to pumps with horizontal shaft. However, the method of balancing by thrust-chambers as above described makes it a simple matter to secure accurate balance even with a single impeller. In vertical-shaft pumps the construction is such as will give a resultant upward thrust, to relieve the step-bearing pressure. Single-stage pumps are, usually, limited to 150 ft. head, or less. For higher heads multi-stage pumps are used, allowing from 100 ft. to (in extreme cases) 200 ft. head per stage. The highest degree of compounding represented in any pumps yet built by this company is eight-stage, but there appears to be no reason why more stages can not be used when required.

The truest help we can render to an afflicted man is not to take his burden from him, but to call out his best strength that he may be able to bear the burden.—Phillips Brooks.

STURTEVANT HORIZONTAL ENGINES.

RECENT modifications of the Sturtevant horizontal engines give them all the features desirable for the driving of connected generators. The design provides ample bearing surfaces, abundant lubrication and light strong parts, admitting of very high speed, which is closely regulated by an automatic governor.

Continuous operation for weeks at a time, with but little supervision, and a minimum loss from friction, is secured by completely incasing the accurately finished parts and providing a system of lubrication that positively and continuously supplies the bearings with oil under pressure. An oil pump operated by the crank shaft draws oil from the reservoir and forces it through pipes and internal passages in the moving parts to the main bearings, the crank pin, crosshead pin and guides, valve silde and eccentric. The pressure of about fifteen pounds per square inch maintains a thin film of lubricant between these metal surfaces, and by preventing contact, greatly reduces friction and wear and insures a mechanical efficiency considerably over 90 per cent. The forced lubrication and complete enclosing of parts result in a clean, durable and economical steam engine.

A watershed partition with a bronze stuffing box is inserted in the frame a few inches from the cylinder. Its position and construction allow ready access to the cylinder stuffing box, while preventing the oil in the frame from entering the cylinder on the piston rod, and making it impossible for the water formed in the stuffing box to get into the casing.

Although enclosed for protection from dust and grit, the moving parts are accessible by means of oil-tight plates or covers on the frame and crank case; or if necessary, the entire crank case may be removed. The frame is bolted to a bed plate, or sub-base, of such proportions and weight as insure freedom from vibration.

A double-ported piston valve, perfectly balanced to minimize power expended for operation, regulates the flow of steam to and from the cylinder. Working in a renewable bushing and having cast iron packing rings turned to a perfect fit, it is easily maintained steam tight. The motion for correct steam distribution is given to this valve through a slide and rod by an eccentric attached to a Rites automatic governor contained in the fly wheel. The range of cut-off is from zero to three-quarters stroke, and the speed is so delicately regulated by automatically altering the point of cut-off that the variation from no load to full load is but one and one-half per cent. To reduce condensation, the casting forming the cylinder and valve chest is heavily lagged with magnesia and asbestos of the best quality, held in place by a panelled cast iron

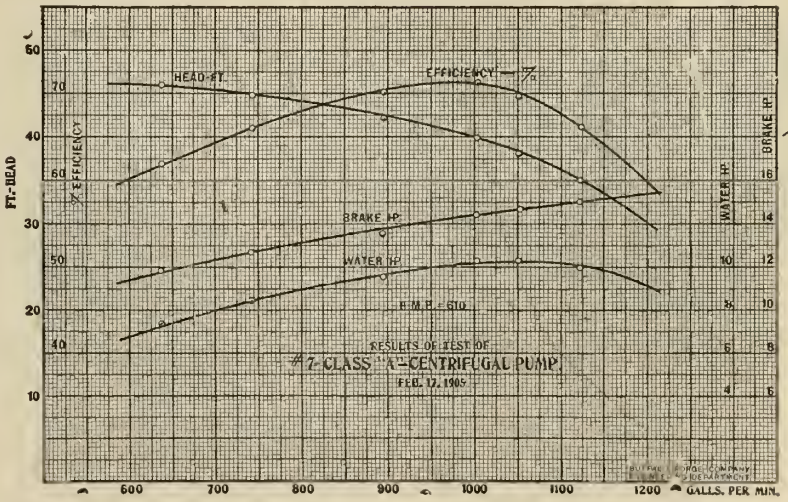

FIG 3—Curves of Results of Tests on Single-Stage Turbine Pump.

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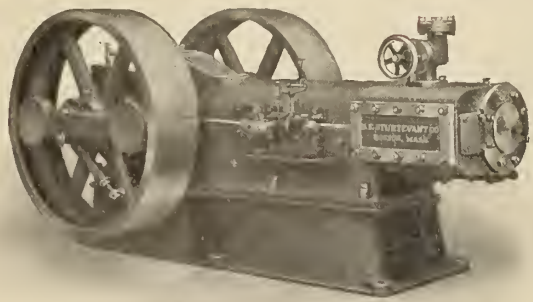
JUL 31 1906

RETURNED
JUL 31 1906
To Drawing Cut Books
Page 22

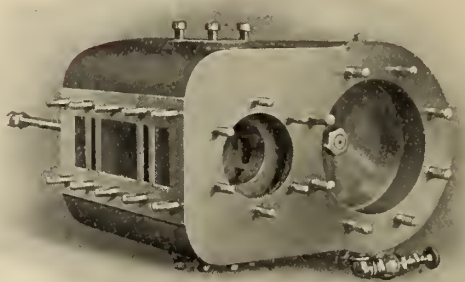
casing of neat design. Damage from water in the cylinder is avoided by placing at each end a relief valve, which may be adjusted to open at any desired pressure. The cylinder is tapped for indicator piping.

For lightness and strength the cast iron piston is cored out and provided with internal ribs; it is fastened to the piston rod, forged from open-hearth steel, by being forced on a taper and then secured by a nut and pin. Cast iron packing rings of best material and perfect fit prevent leakage. The crosshead, moving in guides cast in one piece with the engine frame, is equipped with adjustable cast iron slippers to allow for wear, and provided with a steel crosshead pin flattened on two sides. At the crank-pin end the connecting rod of forged steel has a cast iron box lined with Sturtevant white metal, hammered in and accurately bored; at the crosshead end it is provided with a steel trap, an adjustable key, and a bronze box. The crank pin is extra large. To the webs of the crank shaft, which is forged from a single piece of open-hearth steel, are firmly secured the cast iron counterweights.

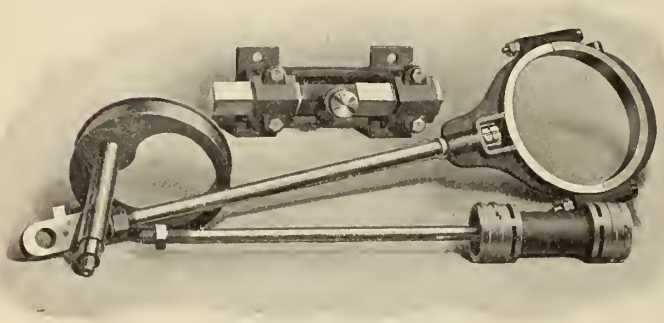
Sturtevant HC1 engines are made with interchangeable parts machined to gauge, and in places where extreme accuracy is desired, scraped to surface plate or finished in the grinding machine. The engine and sub-base has a well-finished surface, while the cylinder, crank case, rim and face of fly wheel, etc., are highly polished.



Sturtevant Horizontal Engine—Fig. 1.

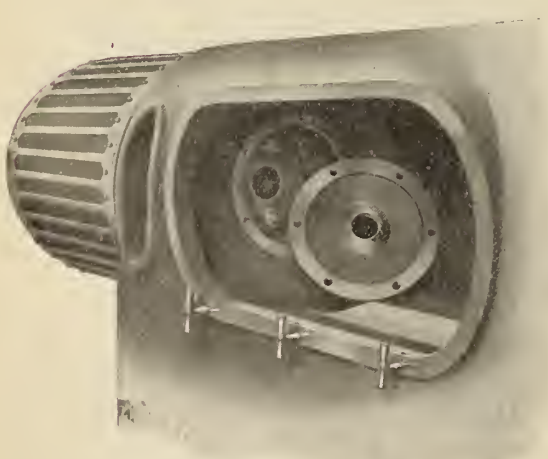


Sturtevant Hoirzontal Engine—Fig. 2.



Sturtevant Horizontal Engine—Fig. 3.

Sturtevant Horizontal Engine—Fig. 4.



Sturtevant Horizontal Engine—Fig. 5.

Sturtevant Horizontal Engine—Fig. 6.

OUR INFLUENCE.

The trade paper is a tremendous selling force. Both through its news and advertising pages it has done more to broaden and develop American industries than all the dailies and all the circulars put together. It has paid its readers dollars on every cent they paid for its subscription. Furthermore, the honest trade paper is here to pay its advertisers in actual business, and if it does not it is not the fault of the medium.—Selling Magazine.

ENGINEERING NEWS

AND SOCIETY NOTES

SOCIETY OFFICERS.

Canadian Mining Institute.

President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer Lamb, Victoria, B.C.; treasurer; J. Stevenson Brown, Montreal.

Toronto Branch A. I. E. E.

Chairman, R. G. Black; vice-chairman, K. L. Aitken, secretary, R. T. McKeen.

Marine Engineers.

Grand president, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N.B.

Canadian Electrical Association.

President, R. G. Black, Toronto; vice-presidents, R. S. Kelch, Montreal, W. R. Ryerson, Niagara Falls, Ont.; secretary-treasurer, T. S. Young, Confederation Life Building, Toronto.

Canadian Association of Stationary Engineers.

President, Wm. A. Sweet, Hamilton: vice-president, Jos. Ironsides; secretary, Wm. Outhwaite, Toronto; conductor, Ed. Grandbois, Chatham; doorkeeper, Chas. Kelly, Chatham.

Ontario Association of Stationary Engineers.

President, A. M. Wickens, Toronto; vice-president, W. A. Sweet; board of directors, W. Blackgrove, W. A. Sweet, A. M. Wickens and A. E. Edkins; treasurer and registrar to be appointed by board of directors.

Canadian Railway Club.

President, S. King; secretary, James Powell, chief draughtsman motive power department, G. T. R.; treasurer, S. S. Underwood, chief draughtsman car department, G. T. R.

Engineers' Club of Toronto.

President, F. L. Sommerville; treasurer, W. J. Bowers; secretary, Willis Chipman, Rooms 96 King St. W.

Canadian Society of Civil Engineers.

President, H. D. Lumsden, Ottawa; vice-presidents, M. J. Butler, Ottawa; C. B. Smith, Toronto; W. M. Walbank, Montreal; secretary-treasurer, C. H. McLeod. Rooms, 877 Dorchester street, Montreal.

Society of Chemical Industry

Chairman, Prof. W. H. Ellis; vice-chairmen, H. H. Van Der Linde, Milton; H. Hersey, A. McGill; hon.-secy., Alfred Burton, 44 York Street, Toronto.

Ontario Land Surveyors.

President, Otto J. Klotz, Ottawa; vice-pres., Thos. Fawcett, Niagara Falls; secy.-treas., Capt. Killaly Gamble, Toronto.

Engineers' Society, S.P.S., Toronto University.

President, K. A. McKenzie; vice-pres., B. I. McGugan, rec. secy., A. M. Damn; treas., G. E. Quance; cor. secy., A. E. Jupp.

RAILROAD AND CONTRACTORS' SUPPLIES.

AMONG the many firms catering to the extensive trade in railway and contractors' supplies, few have made such rapid progress as the St. Lawrence Supply Co., Montreal. The firm have been in business only a few months, but owing to progressive management they are already in possession of a fine plant and are doing a splendid business in contractors' specialties.

About forty men are now employed in their plant on Ontario street east, and more will be added as soon as the machinery now on order is set up. Already there are a number of machines in operation, including steam hammers, a double head vertical boring mill, a punch and shear and others, all being of Canadian manufacture.

The St. Lawrence Supply Co. manufacture steel and iron supplies for railways and contractors. Their product includes the Morden safety switch, which permits of switching without changing the distance signal; the Bladen oil burner, the invention of a Montrealer, which gives perfect combustion without smoke; the Drake concrete mixer, and the Ross impassable cattle guard.

EXCURSION OF THE ENGINEERS' CLUB.

A VERY enjoyable and profitable day was spent by the Engineers' Club of Toronto in their excursion to Buffalo on July 13. In Buffalo the members of the club were the guests of the Buffalo Chamber of Commerce, and were met at the station by Mr. Morse, Commissioner of Public Works, and by Mr. F. H. Mason, secretary of the chamber of commerce, to both of whom the members of the club are much indebted for the royal way in which they were entertained.

The morning was taken up in a visit to the pumping station, which during the past year has been greatly improved by the overhauling of several of the large pumping engines.

The features of the afternoon's programme were the trip in the fire boat around the harbor, the exhibition of the fire system and the visit to the plant of the Lackawanna Steel Co. The famous breakwater surrounding the harbor was of great interest to all, and also the exhibition by the fire department, but the event of the day was the inspection of the Lackawanna steel plant. The officials of the company were untiring in their efforts to show and explain everything to everybody.

There was a special meeting of the club held on the train on the way to Buffalo. At this meeting the applications for membership from the following were accepted: E. L. Cousins, J. M. R. Fairbairn, C. H. Rogers and Edward Crampton. Two representatives to the advisory board of the Guild of Civic Art were chosen, F. L. Somerville and M. J. Haney, and three members were elected to the city plan committee of the Guild of Civic Art, I. W. King, C. E. Goad and I. Tate.

There were 37 members of the club availed themselves of the opportunity to visit Buffalo.

Engineers' Club of Toronto. Chart for July 13th, 1906.

NAME IN FULL..... No.....

ADDRESS, 6 A.M. TO 9 P.M. .....

ADDRESS, 9 P.M TO 6 A.M. .....

IDENTIFICATION MARKS .....

HOURS	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	21	MEAN AVERAGE
TEMPERATURE																					
PRESSURE LBS., E.M.F																					
VACUUM																					
ELATION, IN DEGREES																					
NUMBER OF A																					
B																					
C																					
D																					
E																					
SPECIAL																					

The mean percentage of each hour to be entered. Surviving members are requested to return this card to the Secretary for filing on or before July 31st.

Engineers' Club of Toronto, Chart for July 13, 1906; Excursion to Buffalo.

ON PUBLICITY.

A department of publicity should be a co-ordinate branch of a company's administration. This is heresy now, but it will eventually become orthodox faith.

Publicity is a trade getter, and the largest advertisers recognize that fact and shape their policies accordingly. But the industrial companies are not large advertisers, as advertising goes in these days. The biggest of them spend what the big popular advertisers would think a trifling sum.

But whatever the question may be, the fact is that if you cut down your publicity you reduce your selling power. It may be that you do not wish to sell. — Selling Magazine.

A FIRST CONSIDERATION.

What you say and how you say it are important, but neither is of much consequence unless you address those who are interested in your subject. That is why the choice of mediums should be given first attention.—Selling Magazine.

Machinery Development

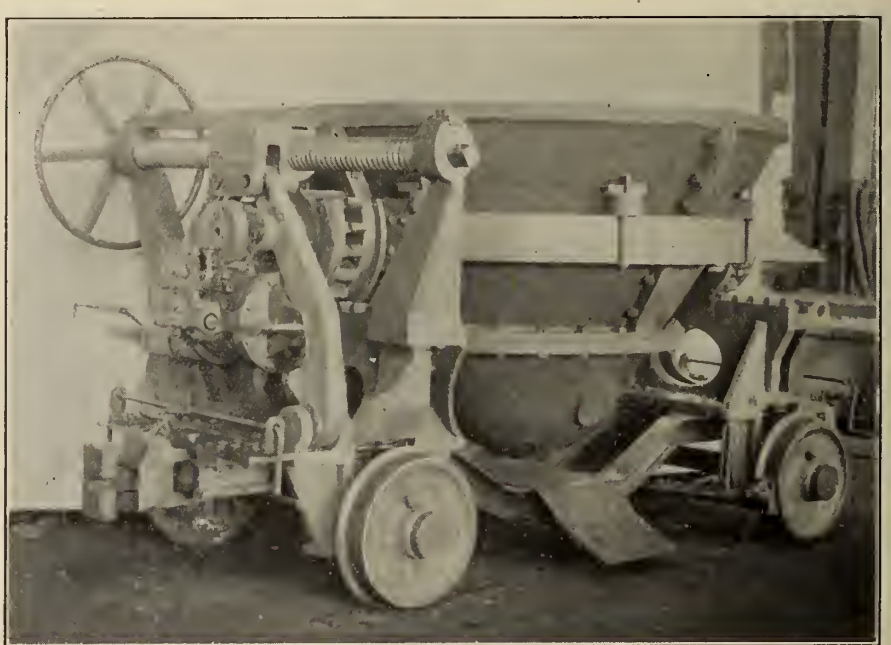
Metal Working **Special Apparatus** **Wood Working**

SMALL "BLISS" POWER PRESS.

TO meet the demand for a small power press to do the work that was formerly done in foot presses, the E. W. Bliss Co., 21 Adams street, Brooklyn, N.Y., has designed and built the small machine which is shown in the accompanying illustration. It is particularly adapted for light work, and is used in the manufacture of burners, light jewelry, and for small hole punching, blanking and forming. While the total weight of this press is only 250 pounds special attention has been given to the design so as to give a strong, compact frame, yet with sufficient die space to accommodate dies of quite some size. The principal dimensions are: Opening in bed, 3-in. diameter; distance back from centre of slide, 3 in.; width of opening in back, 4 in.; distance bed to slide, stroke down and adjustment up, 5 in.; stroke of slide, 1 in.; although the press can be made with 2 in. stroke of slide; diameter and face of balance wheel, 13 in. x 2¼ in.; weight of balance wheel, 50 lbs.; speed of balance wheel, per minute, 150 to 200 revolutions; area of top of bolster plate, 6 in. x 9 in.; height to centre of shaft, 20¼ in.; bench space over all, F. & B. x R. & L., 16 in. x 16 in. The

New Bliss Power Press.

general lines of the presses are similar to the regular Bliss inclinable presses, although some slight changes have been made, due to the small size of the machine. It is fitted with a split sleeve connection having a right and left hand thread, and adjustment is made by simply turning the adjusting screw which is securely locked by means of the two bolts shown. The press is fitted with the Bliss two-piece clutch, which is practically instantaneous in its action, and the wheel, which is a solid web, is bronze bushed.



New Slag Car.

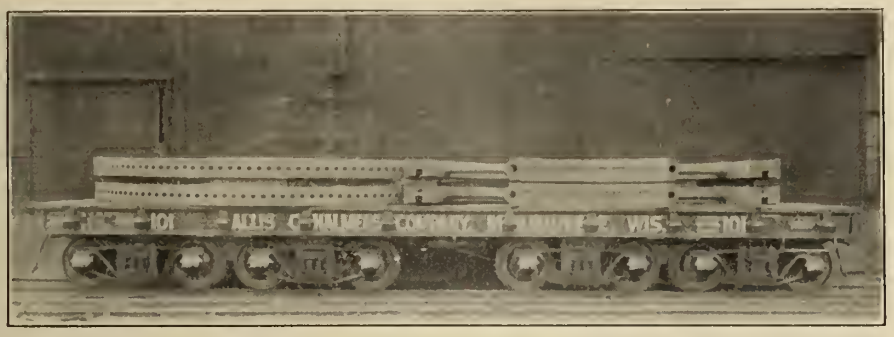
The way these presses are turned out is very interesting. They are made in large quantities in gigs and gauges so that every piece is interchangeable and at the same time is produced at the lowest possible cost, thus enabling the press to be put on the market at a very low figure.

NEW SLAG CAR.

A NEW and interesting type of slag car has recently been designed by the Power & Mining Machinery Co., of Cudahy, Wisconsin. The view shown here is of a ten-ton slag car, of which fifteen were recently built by the above firm for the new Garfield plant of the American Smelting & Refining Co., near Salt Lake City. Some idea as to its size can be gained from the over-all dimensions, which are, 15 ft. long and 6½ ft. high. Each car weighs 27,000 lbs. empty, or 47,000 lbs. when filled with slag. The bowl is made in five sections, the bottom being made in one piece with four quarters forming the top. This allows of any worn or broken part being easily replaced. These sections are securely bolted together and tied to a steel supporting ring by key bolts. The supporting ring is securely riveted to the pinion-toothed trunnions which roll on a racked track. The pinion and the rack are both made open between the teeth to prevent their being clogged by any slag which might be spilled into them. The trunnions are rolled by means of a sleeve which is operated through a lever by a 12-inch compressed air cylinder. This cylinder is designed to operate on 60-lbs. air pressure and to tilt and hold the pot in any desired position. The air valve for this cylinder is a simple four-way cock conveniently operated from the side of the car. All the levers and other operating parts are made of steel to reduce the weight of the machine without sacrificing strength. A hand wheel and screw is also provided so that the bowl can be dumped by hand, should the air supply fail from any cause. When tilted to the extreme position, the side of the bowl makes an angle of 50 deg. with the vertical so as to readily allow the slag skull to slide out. The bowl in dumping is carried to the side of the car by the rolling of the trunnions, so as to dump outside

of the rail. An apron in the middle of the truck prevents any drippings from falling on the track.

The entire body of the car is carried on eight powerful springs placed under the front and read supporting frames and resting on the main bearing boxes. These bearing boxes are fitted with phosphor bronze bearings which are kept lubricated by removable oil waste



Allis-Chalmer's 100-Ton Flat Car.

boxes. The two supporting frames are tied together by two 100-lb. rails securely rivcted to them, and extended to carry the Tower automatic couplers. These are provided with the usual side crank attachment for releasing the coupler. One of each pair of wheels is provided with a bronze bushing so that it can revolve on the axle when going around a curve.

A large factor of safety was used in the design of all the parts of this machine because of the rough usage to which it is put. Special pains were also taken to make it as simple as possible to operate for the men usually employed for such labor.

Slag cars of this design are made in various sizes up to 15 tons in capacity, and with or without the air cylinder.

ALLIS-CHALMERS HUNDRED-TON FLAT CARS.

THE development of power machinery of all kinds, leading, as it has, to the design of prime movers of constantly increasing capacities, has presented some difficult problems of transportation for the larger and heavier pieces of machinery, which have never before demanded solution.

The question of adequate carrying facilities for heavy engine parts has become more and more persistent with the growth of the present tendency toward giant units. The cars used heretofore for the purpose have been especially constructed of heavy material and with a capacity of from sixty to seventy tons. This type of car is, in fact, identical with that employed by the Government for the transportation of heavy ordnance. A new problem in transportation, however, confronted the Allis-Chalmers Company in the case of a huge frame and slide of a monster horizontal rolling mill engine, destined for shipment to the Carnegie Steel Company's plant at Sharon, where it will be installed for heavy service. This single piece which in the rough casting was of approximately 133 tons, will weigh considerably over a hundred tons as a finished part ready for shipment. In seeking a suitable means for overcoming the difficulty of shipping such a piece, it was learned that no single car had ever been built capable of carrying it, and that a special car, designed especially for the purpose, would be the only possible solution. Accordingly orders were placed with the West Milwaukee Car Shops of the C. M. & St. P. Ry., for two sixteen-wheel flat-cars of the required capacity, which are the first of their kind in existence. A few details of construction, showing the unusual sizes of these new cars, are as follows:

Length over end sills, 40 ft. 2 in.
Width over side sills, 8 ft. 9 in.
Height, rail to floor, 4 ft. 4½ in.
Wheel base, 36 ft. 2 in.
Wheels, diameter, 33 in. standard.
Journals, 5½ in. x 10 in.
Weight of car, estimated, between 50 and 60 thousand pounds.
Rated capacity, 200,000 pounds.

The cars are built as low as possible to allow all the clearance space obtainable.

It is decidedly advantageous in building a rolling mill engine, with a capacity like the one in question, to design the frame and slide in a single piece for the purpose of securing the greatest possible rigidity and strength to withstand the racking strains of rolling mill service. This piece in the Sharon engine is the heaviest single casting ever poured at the works of the Allis-Chalmers Company, where some of the heaviest steam-driven units in the world have had their origin. The pattern for this huge casting, measuring 32 feet long, 11 feet wide and 10 feet high, represents the work of ten expert patternmakers for a period of over four months' time; the amount of lumber of various kinds used for the purpose reached the astonishing aggregate of 22,000 feet. The pit dug in the floor of the foundry at the West Allis Works in which this casting was poured, was 40 feet long x 15 feet wide and 11 feet deep. The mold into which the moulten metal was poured took approximately 133 tons of iron, the actual pouring of which consumed from eight to ten minutes. Nine ladles, four with a capacity of 25 tons each, one 13 tons, and four 5 tons each, were used in the operation.

CHAPMAN BALL BEARINGS IN LONDON MACHINE TOOL PLANT.

IN the description of the plant of the London Machine Tool Co., Hamilton, which appeared in the July issue of Canadian Machinery, the fact that the plant throughout is equipped with Chapman double ball bearings was not mentioned. This was an oversight. The London Machine Tool Co. informs Canadian Machinery that these bearings have been very satisfactory in all respects, and that they will be used in further additions which the company are now projecting.

Canadian Pacific Railway Motor Car.

ABOUT CATALOGUES

By mentioning Canadian Machinery to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

Reflections of a Rambler. A very neat little booklet gotten up by the Warner & Swasey Co., Cleveland, O., to advertise their prism binoculars and prism terrestrial telescopes. The use of a binocular or telescope is pointed out in an attractive and original manner in "Reflections of a Rambler," by E. E. Peake.

Screws, Bolts, Nuts. The regular catalogue of the Brantford Screw Co., Limited, Brantford, Ont., containing illustrations and miscellaneous information of their regular product. The catalogue is exceptionally well arranged and is certainly a credit to the company. Size, 5 x 7 1-2 inches.

The Last West. A very handsome bulletin gotten out by Board of Trade, Edmonton, illustrating and describing Edmonton and the agricultural, industrial and commercial opportunities in and around the city. The bulletin is printed in two colors, brown and black, which gives a handsome tone to the illustrations.

McVicker Automatic Gas Engine. A catalogue of the gas and gasoline engines to be made in Canada by the Canadian McVicker Engine Co., Galt, Ont. The engines are well illustrated and described, and because there are some features in the engine not incorporated in the ordinary gas or gasoline engine, the catalogue should prove of more than ordinary interest.

King Edward Induction Motors. Bulletin No. 26, of the Consolidated Electric Co., Yonge street, Toronto, illustrating and describing the King Edward polyphase induction motors, and the King Edward multi-polar dynamos and motors.

Do You Tumble? A very handsome little booklet issued by the Globe Machine & Stamping Co., Cleveland, O., containing descriptions, illustrations and price lists of tilting tumbling boards. It will be noticed that horizontal tumblers and also some patented tumblers are quoted in this booklet, which have not before appeared in the literature of the company.

The Silent Partner. The June and July issues of the Silent Partner, a monthly periodical published by the Globe Machine & Stamping Co., issued for the purpose of "taking our patrons and prospective buyers into our confidence." The publication is certainly unique and very interesting.

Westinghouse Railway Motor. May Circular No. 1129, illustrating and describing the Westinghouse No. 119 O.C. railway motor. The motors are described and illustrated in detail and the operation of several motors are illustrated on an ampere base as regards efficiency, speed, electrical horsepower, brake horsepower, torque at foot radius, and safe time for load in service 20 degrees C rise from 75 degrees C.

Gisholt Warren Works. The Gisholt Machine Co., Madison, Wis., have purchased the plant and patents of the American Turret Lathe Mfg. Co., of Warren, Pa., and are sending out a leaflet showing some exterior and interior views of the plant.

Hot Blast Heating Aparatus. An exceptionally neat booklet, describing and pointing out the advantages of the system of hot blast heating apparatus, being sent out by Sheldons, Limited, Galt. The booklet is well illustrated.

Brakes for Motors. Circular No. 1134 of the Westinghouse Electric & Manufacturing Co., Pittsburg, Pa., illustrating and describing electrical and mechanical brakes for type K. motors of the Westinghouse Co.

Making Stereotype Plates. Catalogue of machine tools and supplies for making curved stereotyped plates for Harris presses, sent out by F. Wesel Mfg. Co., 70-80 Cranberry street, New York. The catalogue is well illustrated.

Core Type Transformers. Bulletin No. 65 of the Crocker-Wheeler Co., Ampere, N.J., illustrating and describing the core type transformers for high tension transmission. The detail construction of the transformer is described and the bulletin is well illustrated. The Packard Electric Co., Limited, St. Catharines, Ont., are Canadian agents for the Crocker-Wheeler Co., and this bulletin may be obtained through them.

I. H. S. Engines. Large catalogue of gas and gasoline engines of the International Harvester Co. of America, Chicago. Portable and stationary engines are described and illustrated. Size, 8 x 10 inches.

Murray Corliss Engines. Catalogue No. 56 of the Murray Iron Works, Burlington, Iowa, describing their standard Corliss engines, high pressure steam boilers and complete power plants. The catalogue is very complete and is exceptionally well illustrated. Size, 9 x 12 inches.

Notes on High-Speed Steel. An interesting pamphlet, of vest-pocket size, presenting the arguments of J. J. Beardshaw & Son, Sheffield, for their "Conqueror" brand of high-speed steel. The Canadian representative of this firm is Alexander Gibb, Montreal.

Westinghouse Protective Apparatus. May, 1906, Circular 1132 of Westinghouse Electric & Mfg. Co., Pittsburg, Pa., describing and illustrating their protective apparatus, including lightning arresters, choke coils, static interrupters, etc. The circular is well illustrated.

Wood Split Pulley. Small descriptive catalogue and price list of "Standard" wood split pulleys, the sole makers of which are the Dodge Mfg. Co., of Toronto, Limited. Besides which the catalogue illustrates and describes special pulleys, including cone pulleys, taper pulleys, iron centre wood rim pulley, patent split friction clutch and sleeve, solid friction clutch mechanism and genuine oak tanned leather belting.

Power and Economy Producers is the title of a 36-page booklet issued by the Williams Gauge Co., of Pittsburg, Pa., giving detailed descriptions of the various steam specialties manufactured by them, including safety feed water regulators, auxiliary feed water regulators, high-pressure steam traps, rotating regrinding gauge cocks, steam pump governors, safety water columns, chain lever water gauge, etc. The book is well illustrated with cuts of a number of large plants where the firm's gauges have been successfully adopted. A copy may be obtained by addressing the Canadian branch, Temple Building, Montreal.

Et Locomotive Brake Equipment. An interesting instruction pamphlet published by the Canadian Westinghouse Co., of Hamilton; contains fifty-nine pages of educative reading matter on the workings of the Et air brake equipment, with many drawings and cuts to illustrate the instructions.

Practical Questions and Answers

In view of interest that is being taken in the producer-gas plant question at the present time, the following questions and answers taken from the 1906 "Question Box" of the Ohio Gas Light Association, will be of decided interest :

Cost of Producer Gas Plants.

Ques.—What is the cost of producer gas plants, suction and pressure types, using bituminous and anthracite coals ? What portion of this cost goes to generators, scrubbers, washers, holders, etc.?

Ans.—The selling price of producer gas plants for engine purposes will be found to average about as follows : Pressure anthracite coal gas producer plant, erected complete, not including freight and traveling, $25 per horse power. The same arranged for bituminous coal, $27 per horse power — these prices being for sizes in the neighborhood of 300 horse-power. Costs are distributed about as follows :

Twenty-five per cent. for producer proper.

Fifteen per cent. for scrubbers and purifiers.

Thirty per cent. for the gas holder and the balance for piping and general fittings.

In the bituminous coal plant the only increase in price will be found in the scrubber and purifier apparatus, which in this case will be 20 per cent. instead of 15 per cent. Roughly speaking, the suction producer plants, both bituminous and anthracite, would cost about one-half the above; the reduction in cost being, firstly, that the producers operating under suction have almost twice the capacity of those operating under pressure, and, secondly, the gas holder is entirely eliminated.

While these figures are fairly close, each installation should be considered separately, as local conditions and the fuel to be employed will have considerable bearing upon the price of the outfit.

The price per horse-power of suction gas producers of from 25 to 250 horse-power of one maker may be represented by the equation :

$$\text{Price per horse power} = \$11 + \frac{400}{\text{H.P.}}$$

Assume a producer in good condition, operated by an experienced producer fireman, furnishing gas for a twelve-hour run to a gas engine running on a reasonable steady load, what should be the average, highest and lowest heat values of the gas during the whole run of twelve hours ? Express the heat value of the gas in lower B.T.U.'s (assumes water of combustion not condensed) per cubic foot, measured at 62 degrees F. and thirty inches mercury.

If a gas producer is designed so that the ratio of air and steam can be controlled automatically for variable loads, the gas should not be higher than 140 B.T.U. nor lower than 125 B.T.U. at any time.

The average highest and lowest heat values on a regular producer plant of correct design would be 155 and 125 B.T.U. respectively. This variation in B.T.U., however, is almost entirely due to the varying percentage of hydrogen in the gas occasioned by the difference in load on the plant. For very steady loads the gas would hold between 120 and 130 B.T.U.

Skill Required by Fireman.

Ques.—How would the skill required by a first-class producer fireman compare with that of a good boiler fireman ?

Ans.—It does not require any special knowledge to run a gas producer. Suction producers are generally run under set conditions, all excess gas going into a holder, while the fireman merely carries out instructions. In any case, producers require very little attention as compared to boilers, and what they do require is not of a high order.

The skill and intelligence required for a producer fireman is the same as that required for a boiler fireman; the difference being, however, that whereas the boiler fireman can be picked up in the market, the producer fireman has usually to be educated up to his work, as this class of labor is very scarce and the good men are practically all employed.

Our experience has been that many first-class boiler firemen fail as producer firemen. Aside from the mere labor of handling a certain amount of fuel there is little similarity in the work; the combustion is conducted on entirely different principles and more intelligence is required to make a good producer fireman.

Depends upon the kind of producer used. With certain producers an ordinary laborer can, with little instruction, operate the producer as well as the most experienced fireman. With the Smith automatic suction producer the only labor that is required is to charge it in the morning and have the grates cleaned and blown and it is ready for a twelve to sixteen-hour run. Then the fireman may work at anything else after the engine is started till time for shutting down.

Equal—power for power. But for equal skill the wages of the gas producer fireman would be greater because of the limited supply.

Influence of Compression.

Ques.—Does the compression influence the horse-power of a gas engine ? If so, how and why ?

Ans.—A weak mixture of poor gas with the air necessary for combustion may be made combustible by high and rapid compression. In the engine cylinder the fuel gas is diluted by the nitrogen in the incoming air, and also by the burned products left in the clearance space. This mixture must be highly compressed to bring the particles of the combustible gas and oxygen close together and thus insure a certain ignition and quick combustion. If a quick combustion does not take place, the hot gases, at their highest temperature, are exposed to a larger surface on the cylinder walls, which causes a relatively great loss of heat. Besides, a higher rate of compression forces a greater weight of gas into the clearance volume, and the ratio of the cooling surface of the cylinder walls per unit of weight of gas is smaller at the highest temperature of explosion.

At the same time the rapidity of combustion increases the amount of heat per unit volume, and this heat is more rapidly converted into work done on the piston. The maximum pressure reached in the explosion stroke allows a greater range of expansion of the products of combustion after the heat is generated and increases the range of temperature in the cycle, which directly increases the thermal efficiency. However, as the compression is increased, the work the fly wheel is called upon to do in carrying the engine through the cycle is increased and a medium must be found by experiment at which the highest efficiency is obtained.

The pressure, after explosion in a cylinder, is about four times the initial compression (both these pressures being above atmosphere), so it is easily seen that an increased compression greatly increases the M.E.P. of the stroke and consequently the horse-power.

Objections to excessive compression are excessive heating of cylinder walls, causing pre-ignition and increased leakage past piston rings and valves.

The Need of a Practical Education*

BY THOMAS D. WEST

THE American Foundrymen's Association was organized for the purpose of encouraging research in the art of founding, for disseminating the knowledge of its principles, and aiding in the improvement of daily practice in all its branches. While it is said that this is a practical age, that designation is far less warranted than might be wished. In the pernicious activities of so-called reformers and in the vague conceptions and theories widely entertained a possibility of danger that should be cause for serious consideration. There is so much of the impractical and incompetent in modern life that these are responsible for more strife and ill success than all other evils combined. Not one person in fifty is as thoroughly practical and competent as he should or could be, and the foundry business gives ample proof of the shortcomings of those who are presumed to be skilled artisans. The deficiencies in modern industrial life are to be attributed to the fact that our schools do not give the rising generation the practical training they should have.

The allurements of a life of ease and refinement to which the Caucasian race is so partial find expression in the pursuit of a professional or classical education and the ignoring of manual pursuits because they may involve hard work and dirt. If this evil is not corrected the day will come when all classes of our people will suffer keenly for the errors of impractical parents and instructors.

There are two factors which must be taken into account more fully in our educational system as well as in our home training if better conditions are to be realized in the future, and these factors are: a practical education and manual skill. When on every hand there are to be found young and old unable to earn a living for lack of the above mentioned factors in their education, when there is a great demand for manual skill, which, as a rule, requires as much time and effort to be attained as the schooling now in vogue, if not more, why should not manual skill be respected and encouraged more than it is?

Practical Training Advocated.

The education of our youth should be confined to that which can be directly utilized. The time wasted in ornamental studies that can never be made use of ranges from one to four, and often more, of the most precious years of life, and passes many on to an age when they cannot take up studies or an apprenticeship which in a few years might enable them to make a good living. All children should have a common school education, but when they have attained this the parents or guardians should discover, if possible, the capabilities of their children and then decide for what vocation they shall be trained. Even special study that does not bear directly on the vocation to be followed should be put aside. What is a necessity should be studied with zeal and a regard for the saving of all time possible. What sense is there in spending valuable time studying subjects which, because they cannot be utilized, will soon be forgotten?

Few of our educators are in a position to comprehend the necessity of the practical as compared with the book work of the professional or classical student. Every energy has been directed to perfecting the latter, and now this should be done for the former. Good literature on the practical aspects of life and the attainment of skill can be made to serve as text-books as much as studies on political economy, history and English literature. Once it is recognized that there is as much need of the practical as the professional, and text-books will be forthcoming that will improve the views of the masses in a way now impossible. It is not to be expected that a change of this kind can be made in a few years, as the machinery of education is naturally devised at the present time for carrying out the contemporary tendencies. Even our universities and colleges are at the present time driven to combat the evils of excess in sports, which, unfortunately, are strongly backed up by the public support given to athletic games. The excesses in this line are now so opposed to the aims of these institutions that at a recent gathering in New York City, of professors and instructors, measures were taken to prevent the loss of time now resulting from these games, to the great detriment of classroom and laboratory work.

Specialization Demanded

The revolution in industry through the specialization of the past 10 or 20 years is a move toward the attainment of the practical in science that has not received the recognition it deserves. It really means that no one should expect to master more than one vocation. At one time an individual could undertake to be master molder, machinist and blacksmith, but this is not possible now. All who are highly skilled in the art of founding know that he who wishes to be in the lead, or the master of the sand heap and cupola, either as a worker or manager of men, can spend every minute of a ten-hour day in the shop and his evenings in study and research during a long life, and still have much to learn.

To be practical people we must, in connection with the other reforms mentioned, specialize our studies and labor so as to be masters of one vocation, not "jacks of all trades and masters of none." The smatterer or "would be" is an affliction that causes many of our industrial enterprises great losses and perplexities. To the lower working classes it means high cost of living and often much misery, which is entirely uncalled for and should not exist.

The starting of the reform needed would lie chiefly with our leading associations. Let them appoint committees consisting of men broadly experienced in the actual work of all lines of endeavor they represent, to select the subjects to be followed after passing through the grammar school grades, as well as to designate what the demands are for the employment of skilled workers in their respective lines. These associations should include, among others, architects, blacksmiths, the business professions, carpenters, chemists, civil engineers, draughtsmen, doctors, editors, electricians, farmers, masons, mechanical engineers, metallurgists, mining engineers, ministers, molders, patternmakers, painters, plumbers, and down the list to supply men, stationery engineers and wheelwrights.

A founders' committee would not, I think, recommend the wasting of time by those wishing to learn the art of molding upon studies that could rarely, if ever, be utilized. In fact, the preparatory study could be narrowed to a common school education, with drawing, chemistry and some metallurgy. The latter three could be taken after leaving the regular school as special studies in day or night schools under some instructor or technical institution knowing just how much of these studies the molder, foundry foreman or manager should pursue. This committee, aside from recommending what special studies were necessary, could also set forth the title of such books as should be read at leisure, in addition to those used as text books.

The Foundrymen's Association Doing its Part.

This address may be considered as an appeal for a reform in education and home training to an association that with a few others stands foremost in

* Abstract of President's address before the American Foundrymen's Association, at their eleventh annual meeting, Cleveland, Ohio.

doing what can be rightly commended as advancing civilization. What greater liberality of spirit can be shown by a body like the American Foundrymen's Association than for its members to give gratuitously to the world their trade secrets and experiences, which cost them great labor and often great expense, and which but a few years ago, comparatively speaking, all would have held in their strong boxes.

We have Socialism and other isms asking for public support, but few have given this and other kindred associations credit for putting aside selfishness, for gratuitously distributing information, and creating among rivals in trade a co-operation beneficial to the masses as well as themselves.

There are over 5,000 proprietors of foundries, and as many more superintendents and foremen, besides allied interests, such as chemists, patternmakers and supply men, that should take great interest in our association's work. There are many who naturally do take a great interest, and those who do not would doubtless do so were they to attend one of the meetings or to take the time to investigate the good work that has been accomplished by our members helping each other to advance knowledge and skill in the art of founding.

While much good has been accomplished by our association, there is still greater work before us; but to do this properly we should have a much larger membership. It is to be hoped that this Cleveland convention will result in giving an impetus in this direction. In justice to ourselves we cannot recede; we must enlarge and press forward. Can we say more in soliciting outside craftsmen to join us? Education is our association's motto, and by making it as practical as possible we can do a great good in helping to make this world grow better. This association and kindred societies will certainly have to labor for more practical methods of instruction if, as a people, we expect to develop the needed skill in our artisans or to obtain the greatest comfort and happiness for the masses.

RAILWAY EXTENSION WORK.

Arrangements are being completed by the Grand Trunk Pacific Railway for the transportation of 289 cars, engines and steam shovels from Montreal to Portage la Prairie, the point at which the construction of the new transcontinental line commenced. These cars and locomotives form Grand Trunk Pacific rolling stock, and their movement to the west means the inauguration of advanced construction work.

At the Noon Hour

ELECTROPHOBIA.

THEN the passen said they wid have to build 'lectrical works and have a watter-will to drive the dominoes. Wat the dominoes be for I carn tull 'e, onless 'tis for the workmen to play wi' day times when thur idden no light wanted. Then all you'd have to do wid be to press a button, an' there you'd be.

Wull, then up gets ole 'Lias Grant. "Shan't 'ave nort to do wi't. Thayse yer noo-fangled things be a-temptin' o' Providence. The Lord send'th us the darkness, therefore 'tis meant for our gude, and us got no right to try to counteract the work of Providence. If such things was carried out there wid be a judgment on the parish some time or nuther; same's 'twas at Little Critchcombe, where the passen insisted on doin' away wi' the old high pews wat 'ad been in the church ever since 'twas a church an' puttin' in a passel of cheers; an' the very nex' wik nearly ev'ry pig in parish 'ad swine-faver. Therefore, he shid voat agin it. Our fathers graupid their way about in the dark, he said, an' so did our gran'fa's; an' wat was gude nuff fir they was gude nuff fir we."

There was a gude many wat was 'Lias's way o' thinkin', and they gid the ole chap a gude clap for spaikin' up so wull; to the squire an' all.

Than ole Sammy Bussacott got up, an' said what he objected to was the buttons. 'E adn' got a word to say 'gin the 'lectric light nor any other kind o' light; but they buttons was wat 'e objected to. Buttons was a nuisance, Sammy reckoned. They was orwiz comin' off. 'E'd jiss ad wan come off, now, since 'eed bin in the meetin', on'y droo pickin' up his pipe off the floor. And now 'eed on'y got one left to go home wi', and if aught shid happen to thiky, a purty fine hole he'd be in. That was yer buttons, and he widden have nort to do wi'm. If the 'lectric light cude be worked wi' a bit o' string instaid o' buttons he 'adden got a word to say agin it. But if so be it must be buttons, then he widden have it at no price."

"Wull, Tom, and wat was the end o't?" says Billy Snell.

"Au! the buttons do'd it," said Tom. "Arter that noan o'm hardly widden voat for 't, an' so it falled droo. In fac' yu mid say it valled droo the button-hole."

—Western Weekly News.

If one employer doesn't see your merit another will.

A MODERN CHRICTON.

To the Chairman of the Council—Sir, I notice you require
A working electrician (list of duties as per ad.)
And in making application for this post which I desire,
Would enumerate in passing, the advantages I've had.

I have passed examinations in approving installations,
In jointing up concentric, and in balancing my books.
I am quick at understanding any startling innovations,
And have been, by many persons, complimented on my looks.

I am used to cleaning arc lamps, and to making house connections,
I am good at correspondence and at laying sundry mains,
Gas and water, and electric. I can carry out directions,
And have many testimonials for my way of testing drains.

I can keep all books of record needed by your undertaking,
And require no unskilled labor to assist me in my work.
I can fix, and read the meters, and can help you in the making
Up of quarterly accounts, and you will never find me shirk.

I'm delighted at the prospect of pedestrian excursions
Switching on and off your street lights, and shall never seek a tip.
And if your quaint revivals should require complete immersion.
I would voluuteer my services to superintend the dip.

I have not the least objection to assisting with the sweeping
Of the streets that you are lighting, or to helping pave the same;
Or to waiting at your banquets. Both in waking and in sleeping
I shall use my best endeavors to enhance your council's fame.

I may add I wear a collar, and could occupy my leisure
Playing bridge, or entertaining in your lofty social sphere.
So, trusting to be favored, and awaiting your good pleasure,
I remain, yours most sincerely,
John Alfonso Vere de Vere.

—The Electrical Times.

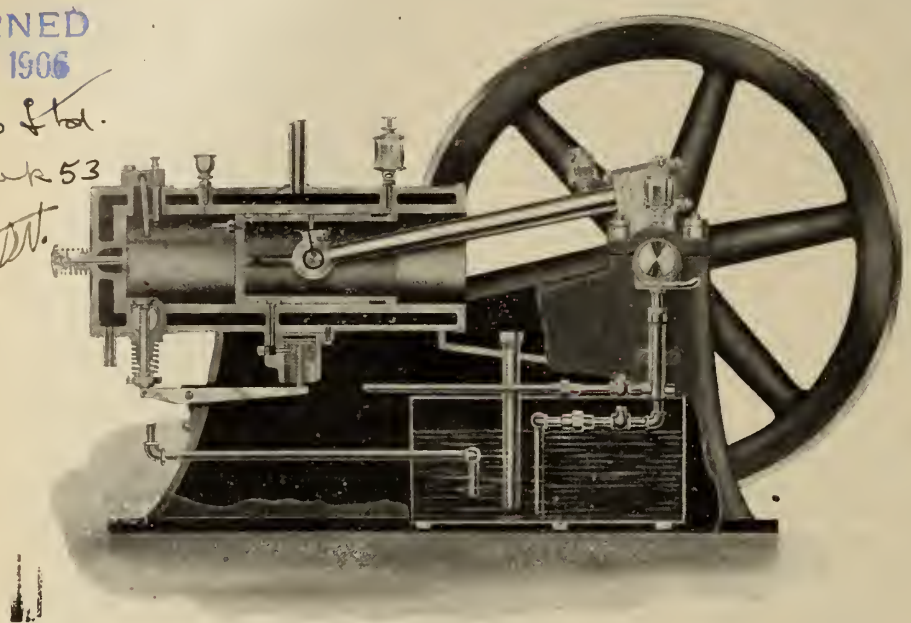
TRAINED MEN.

This is the day of the trained man. In competition with him, the untrained man, or the poorly trained man, cannot maintain himself. Do not be afraid of too much theory. Never was good practice which was not preceded by and based upon good theory. Let your theoretical training be broad and deep. It is your only sure foundation for the best work.—Henry S. Pritchett, president of the Massachusetts Institute of Technology.

THE McVICKER GAS ENGINE.

THE CANADIAN McVICKER ENGINE CO., LIMITED, are starting a large gas and gasoline engine works in Galt, Ont., and they will be associated with the Alma Manufacturing Co., Alma, Mich. The Canadian company will build the McVicker engine, which is being built in the United States by the Alma Manufacturing Co. This engine has some very distinct features of its own, and a description and illustration of it will be of interest.

RETURNED
JUL 25 1906
To Grip Ltd.
Cut Book 53
Page 1



The McVicker Engine.

The engine is a four-cycle one, but is built without gears, cams, eccentries or trigger work of any kind. The arrangement of the valves may be seen from the accompanying sectional view of the engine. The inlet valve is of the simple poppet type placed in the back of the combustion chamber, which is situated directly behind the piston, the full force of the explosion thus being obtained on the piston. The exhaust valve also is of the poppet type operated by the exhaust itself through a by-pass as seen in the sectional view. The advantages of this, besides its simplicity, are that no power is taken from the crank shaft for the operation of the valve and an unignited charge is preserved instead of being expelled through the exhaust port, as in engines with mechanically operated valves.

The method of governing is of the "hit and miss" style, and the company guarantee that the engine will govern on variable loads within a fraction of one per cent.

In the McVicker carbureter the gasoline is atomized by mixing it mechanically with air. The atomizer requires no adjustment for varying loads, and thus the needle valves need not be moved after once set.

The base of the engine is a heavy casting reinforced at crank bearing. The cylinder is provided with an extra large water jacket, and is fitted in planed ways to secure good alignment. The crank and connecting rod are drop forgings, and the bearings are made of special composition brass. The piston rings are four in number, and are turned concentric. The igniter is a positive "make and break" type, and is located on the top of the cylinder. The points can be readily examined by simply removing two screws. All the parts are made from jigs, and thus are interchangeable.

Up to the present these engines have not been sold in Canada, but the Canadian company intend to build the engines in sizes from 2 to 100 h.p.; but at present, however, only the smaller sizes from 2 to 30 h.p. will be made.

THOR PNEUMATIC SAW.

THE Independent Pneumatic Tool Co., of Chicago, has recently placed on the market a novel and interesting machine, as per accompanying illustration. This machine is operated by compressed air, and is designated as the "Thor Pneumatic Saw." This machine is especially designed for use in railroad car shops and by shipbuilders, car builders and contractors, for cutting and trimming roofs, doors, sides, floors, etc. It weighs only 20 pounds and has a speed of 8,000 r.p.m. The length of same is 14 in.; width, 4½ in.; height, 9 in.

This machine is easily handled and operated by one man, and no experience is necessary for the use of same. It will cut one inch thick lumber at the rate of sixty feet per minute. A governor automatically controls the speed of the machine, and is adjustable in case different speeds are desired.

The machine is made from suitable and highest grade of material, and nothing in its construction is liable to destruction, or any parts to wear out. All bearings are covered and revolve on the very best grade of steel balls. The great velocity of this machine necessitates highest class of workmanship, and the utmost care in balancing the working parts, and for this reason the machine is free from vibration. It is a great time and labor saver, and can be used on the finest class of cabinet work without soiling the product by oil or grease, as no lubrication is necessary, except a few drops of light oil occasionally inserted through the ends of the shafts.

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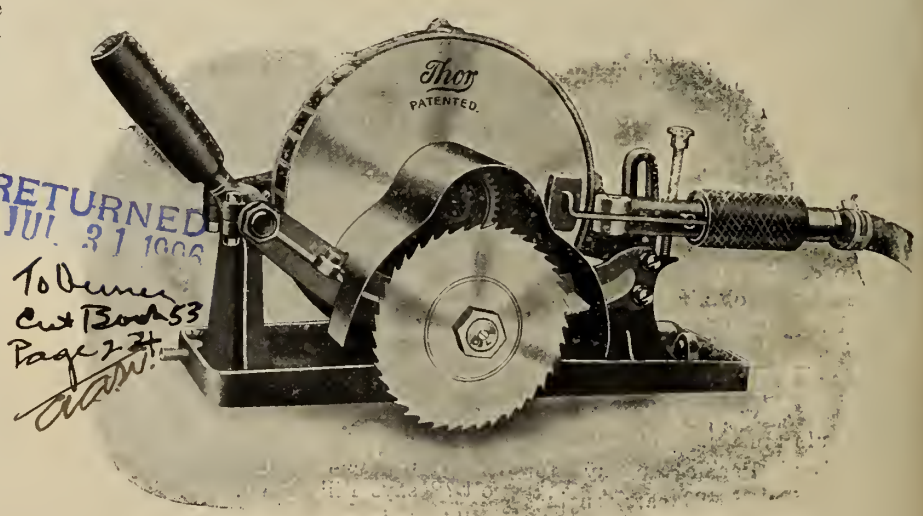
Page 2 3



The "Thor" Pneumatic Saw.

Exhaustive tests have been made of this machine in some of the largest railroad and car shops, and the results obtained have been eminently satisfactory.

Companies Incorporated

Turret Crown, Limited, Toronto ; capital, $125,000 ; purpose, to build and operate steam vessels. Directors are : A. W. Mackenzie, D. B. Hanna, L. W. Mitchell, all of Toronto.

The Pure Ice Co., Limited, Montreal ; capital, $95,000 ; purpose, to manufacture and cut ice. Directors are : B. Sawyer, N. C. Smillie. E. P. Sawyer, H. Timmis, all of Montreal.

Ames-Holden, Limited, Montreal ; capital, $2,500,000 ; purpose, to manufacture leather and rubber footwear. Directors are : Jas. Redmond, H. B. Ames, A. R. Holden, all of Montreal.

Herron-Leblanc, Limited, Montreal ; capital, $90,000 ; purpose, to manufacture and deal in grocers' and druggists' supplies. Directors are : J. LeBlanc, R. S. Herron, W. H. Johnson, all of Montreal.

West Ontario Oil Co., Limited, Petrolea, Ont. ; capital, $100,000 ; purpose, to carry on the business of oil operators and producers. Directors are : D. Eastman, J. W. Craise and A. McIntyre.

Boswell & Brother, Limited, Quebec ; capital, $500,000 ; purpose, to carry on the business of brewers, maltsters, etc. Directors are : V. Boswell, J. W. Boswell, A. W. Boswell, C. E. A. Boswell, all of Quebec.

The Leach Piano Co., Limited, Montreal ; capital, $145,000 ; purpose, to manufacture and repair pianos and other musical instruments. Directors are : W. H. Leach, A. L. Dupont, L. O. Boucher, all of Montreal.

Superior Oil Co., Limited, Sault St. Marie, Ont. ; capital, $500,000 ; purpose, to manufacture and deal in oils, greases, soaps and similar products. Directors are : E. L. Stewart, Andrew Elliott and D. I. Millar, all of Sault St. Marie.

Berard & Major, Montreal, have been incorporated with $200.000 capital by Dominion charter proposing to make vehicles of all kinds. The incorporators are A. Berard, E. Major. J. Berard, G. Major and J. M. Mercier. all of Montreal.

The Schofield, Holden Machine Co., Limited, Toronto ; capital, $40,000 ; purpose, to carry on the business of engineers, machinists and shipbuilders. Directors are : Richard Schofield. A. P. Holden and M. H. Anderson, all of Toronto.

The Ottawa Wine Vault Co., Limited, Ottawa ; capital, $250,000 ; purpose, to manufacture and deal in wines and other liquors and cigars, etc. Directors are : G. Lebel, A. Charbonneau, T. J. Brule, J. L. Matte and P. Prudhomme, all of Montreal.

Grand Trunk Pacific Terminal Elevator Co., Limited, Montreal ; capital $5,000,000 ; purpose, to carry on elevator and warehouse business. Directors are : C. M. Hays, Wm. Wainwright, A. P. Stewart, W. H. Biggar, all of Montreal, and N. Bawlf, Winnipeg.

La Compagnie Chiminique Uinot, Limited, Montreal ; capital, $20,000 ; purpose, to manufacture and deal in pharmaceutical and chemical products. Directors are : A. Chevalier, A. Chapdelaine, L. J. Berard, A. La Malice, F. Poupart, all of Montreal.

The Manufacturers' Natural Gas Co., Limited, Hamilton ; capital, $200,000 ; purpose, to bore for natural gas and to manufacture artificial gas for all purposes. Directors are : John Milne, Wm. Southam, W. G. Walton and G. I. Staunton, all of Hamilton.

The Composite Brick Co. of Parry Sound, Limited, Parry Sound, Ont. ; capital, $20,000 ; purpose, to manufacture and deal in artificial stone and all kinds of compressed or paving brick, etc. Directors are : C. A. Phillips, G. G. Gladman, A. Logan, all of Parry Sound.

The Improved Shuttle Co. of Canada, Limited, Montreal ; capital, $30,000 ; purpose, to manufacture and deal in shuttles, looms and mill supplies of all kinds. Directors are : H. D. Metcalf, C. P. Metcalf, C. N. Blakely, W. S. Hutchison and F. C. Saunders, all of Montreal.

The Supreme Heating Co. have been formed at Owen Sound with $200,000 capitalization by S. J. Parker, A. J. Ross, W. R. Hampden, W. Taylor and A. G. MacKay, all of Owen Sound. The company proposes to manufacture stoves, ranges, furnaces and other heating goods.

Gallagher Iron Mining Co. have been incorporated under Ontario charter, with a capital stock of $500,000, to carry on a general mining and reduction business. The provisional directors are F. P. Sullivan, J. J. Gallagher and F. H. Hughes, with head office at Sault Ste. Marie.

The Clark Automatic Nut Lock Co., Montreal, capitalized at $500,000, has secured a Dominion charter and propose to manufacture bolts, nuts and other metal goods. J. D. Good. E. James. W. J. Henderson. J. Rockwell, and E. Lanquedoc, all of Montreal, are the incorporators.

The Stevens-Hepner Co., has been organized with headquarters at Port Elgin. The company will manufacture brushes, woodenware, etc. The capital stock amounts to $150.000, the directors being H. H. Stevens and Jno. Hepner, of Port Elgin, and C. M. Bowman, of Southampton.

The Portland Cast Stone Co. have been incorporated under Ontario charter, with a capital stock of $40.000, to manufacture and deal in cement, limestone, plaster, etc. The provisional directors are W. F. Colwill, J. T. Colwill and W. W. P. Colwill, with head office at Guelph.

North Ontario Reduction & Refining Co. have been incorporated under Ontario charter, with a capital stock of $500.000, for the purpose of carrying on a general mining and reduction business. The provisional directors are J. A. Young, jr., H. R. Ritchey, J. J. Wright, D. G. Bremner and J. S. Tomlinson, with head office at Toronto.

Para Construction Co., Limited, Toronto ; capital, $2,000,000 ; purpose, to carry on a general construction business including the building of tramways, docks, piers, reservoirs, embankments, etc. Directors are : J. S. Lovell, Wm. Bain, Robt. Gowans, E. W. McNeill and W. F. Ralf, all of Toronto.

The Canadian McVicker Engine Co., Limited, Galt, Ont. ; capital, $100,000 ; purpose, to acquire the patent rights covering the McVicker automatic gas and gasoline engines, and to manufacture the same. Directors are : J. R. Golden, C. L. Weisner, T. J. Lannen and H. H. Tillinghaste, all of Galt.

The Canada Dredge Manufacturing & Purchasing Co., Limited, Newcastle, N.B. ; capital, $500,000 ; purpose, to manufacture and deal in dredges and dredging machinery. Directors are : W. H. Russell, Newcastle ; H. D. Aiton, Redbank ; G. J. Sproul, W. L. T. Weldon and R. A. Murdock, all of Chatham, N.B.

The Script Weight Recorder Manufacturing Co., Limited, Joliette, Que. ; capital, $49,000 ; purpose, to manufacture a record-making apparatus for weighing scales under the patent rights of L. V. Lahelle, and to carry on business of manufacturers, founders and machinists. Directors are : S. P. Champoux, J. M. Tellier, L. V. Lahelle, L. P. Deslongechamps, all of Joliette.

Railway Supplies, Limited, have been incorporated under Ontario charter, with a share capital of $250.000, for the purpose of manufacturing rails, rail joints, etc., and all articles into the manufacture of which metals enter. The provisional directors are J. S. Lovell, Wm. Bain, Robt. Gowans, E. W. McNeill and W. F. Ralph, all of Toronto, and the head office to be at Toronto.

Oil Well Supply Co., Ltd., have been incorporated under Ontario charter, with share capital of $100.000, for the purpose of carrying on the business of a general machine shop and the manufacture of drill tools, etc., now carried on by the Oil Well Supply Co. The provisional directors are James Joyce, J. A. MacKenzie and E. A. Westland, all of Petrolea, with the chief place of business at Petrolea.

The Canadian Rail Joint Co. have been incorporated under Ontario charter with a share capital of $250.000, for the purpose of manufacturing rails, rail joints, etc., and all articles into the manufacture of which metals enter. The provisional directors are J. S. Lovell, Wm. Bain, Robt. Gowans, E. W. McNeill, W. F. Ralph and S. G. Crowell, all of Toronto, with chief place of business at Toronto.

The Renfrew Brick & Tile Mfg. Co. have been incorporated under Ontario charter, with a share capital of $20,000, for the purpose of taking over the business of Thos. Henderson, of Renfrew, and of manufacturing and dealing in brick, tile, artificial stone, etc. The provisional directors are Thos. Henderson, J. E. Barnet, Allan Francis, P. S. Stewart and Robt. Leitch, all of Renfrew, with head office at Renfrew.

Welland Concrete Co., Limited, have been incorporated under Ontario charter, with a share capital of $200,000, for the purpose of manufacturing and dealing in brick, cement blocks, gravel, stone, builders' supplies, etc. The provisional directors are George Arnold and J. P. Eastman, of the Township of Pelham, County of Welland; B. J. McCormick amd S. P. Townsend, of Windsor, and C. F. Berry, of Detroit, Mich., with head office at the Town of Welland.

The Canadian Newcombe Motor Co. have been incorporated under Dominion charter, with a share capital of $600,000, for the purpose of carrying on the business of manufacturing and dealing in power generators and motors, and to construct vehicles, agricultural implements, etc. The provisional directors are W. F. Borland, Westmount, Que.; Duncan McDonald, W. J. White, F. L. Wanklyn, and P. F. Richardson, all of Montreal, with head office at Montreal, Que.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

Arden, Man., residents will build a $10,000 hotel.

Vegreville, Alta., will build a hospital to cost $6,000.

The Y.M.C.A., Edmonton, will build a $60,000 building.

J. Malcolm is to erect a $16,000 hotel at Claresholm, Sask.

A new school will be built in Toronto East, to cost $47,000.

Peterborough will have an isolation hospital to cost $10,000.

Sova & Barbour have opened a plumbing shop at Winnipeg.

A foundry to do general work is to be opened up in Saskatoon, Sask.

A large addition is being made to the New Ontario hotel at Fort William.

Osler, Hammond & Nanton will erect a $200,000 office building in Winnipeg.

P. J. Manion is preparing plans to erect a $250,000 hotel at Fort William.

Seaforth has voted the W. H. Willis Shoe Co. $10,000 to establish a shoe factory.

Japanese metal buyers are looking to Canada for future supplies of nickel and carbide.

The Hamilton Bridge Works are to build an addition to their works 400 x 420 feet.

Additions costing $145,000 will be made to the Miserecordia Hospital at Winnipeg.

John Pentland is promoting a company to manufacture cement blocks at Brantford.

St. Mary's (Ont.) capitalists are contemplating starting a rubber works in that town.

The Dominion Packing Co., of Charlottetown, P.E.I., asks tenders for its entire plant.

The new hotel to be built by the Castle Hotel Co., at Edmonton, will cost $70,000.

The Peterborough & Chemong Auto Car Co. have been formed, with a capital of $5,000.

The German Cardboard & Photo Mount Co. are to establish a factory at Peterboro.

A New York firm is contemplating establishing a pulp mill at Charlton, in New Ontario.

The German Cardboard & Photo Mount Co. will build a factory at Peterborough.

W. Bentham, Montreal, is to build a large apartment house to be called the "Cavendish."

The Eastman Cutlery Co. are negotiating with London with a view to establish there.

The Canadian Folding Box Co., Brantford, are looking for a site for enlarging their plant.

The Vulcan Boiler Works have commenced the manufacture of boilers at New Westminster.

The Cockshutt Plow Co., Brantford, intend to build an addition to their three storey warehouse.

Sault St. Marie, Ont., has passed a by-law providing for the installation of a waterworks system.

The Frontenac Gas Co. is to establish a new gas plant at Quebec in opposition to the existing company.

The Fredericton, N.B., Gas Co. are to spend $10.000 this Fall in improving their electric lighting plant.

The Banwell-Hoxie Fence Co., of Hamilton, are to build an addition to their factory to cost $2.500.

Goderich has passed a by-law to guarantee bonds amounting to $150,000 for the Maitland River Power Co.

A new factory is to be established in Brantford to occupy the works to be vacated by the Brantford Screw Co.

The Great Northern and Northern Pacific railways are talking of erecting a $750,000 hotel at Vancouver, B. C.

The Peterborough Shovel & Tool Co. have decided to erect a new brick warehouse, 40 x 100 feet, at a cost of $3,000.

Sir Thomas Lipton is said to intend to spend $2,000,000 in the establishment of a meat packing industry at Winnipeg.

Norwich, Ont., is to vote on a by-law to grant a loan of $5,000 to West, Taylor, Bickle & Co., broom manufacturers.

The McKinnon Dash & Metal Works Co. have reduced the amount of their common stock from $400,000 to $100,000.

The Montreal Street Railway are going to build a power house in the Hochelaga ward, Montreal, at a cost of $801,000.

The Brantford Roofing Co. are installing machinery in their new factory and will be ready to start in a short time.

The Chalmers Milling Co., East Toronto, are erecting a concrete elevator, 40 x 60 feet in connection with their mill.

The Kay Electric Dynamo & Motor Co., have moved to their new factory and offices at 740-142 Yonge street, Toronto.

John Williamson, Ottawa, has placed an order with the Smart-Turner Machine Co., Hamilton, Ont, for a power pump.

The Bell Telephone Co. are to erect a $33,000 telephone exchange in Toronto and another at Kew Beach to cost $5.000.

New York and Edmonton promoters are endeavoring to secure a street railway franchise from the Town of Prince Albert.

The factory of the Brantford Roofing Co., Brantford, is now running to its full capacity, twenty men being employed.

The Canada Machine Telephone Co., who have a competitive franchise in Brantford, have started to install their system.

The Jenckes Machine Co., have ordered three set of shanking crates from the Smart-Turner Machine Co., Hamilton, Ont.

E. Leonard & Sons, London, have ordered an independent jet condenser from the Smart-Turner Machine Co., Hamilton, Ont.

The Climax Road Machinery Co., Marathon, N.Y., proposes establishing a Canadian factory and may locate at Hamilton.

H. McKenzie, Sydney, Australia, was in Peterboro last week securing prices on saw mill machinery for shipment to Australia.

The J. B. Armstrong Mfg. Co., Guelph, have placed an order with the Smart-Turner Machine Co. for a standard duplex pump.

The Smart-Turner Machine Co., Hamilton, Ont., have supplied a girder frame slide valve engine, to Rev. Jos. Oster, Hull.

The Hillrust Grape & Wine Mfg. Co., St. Catharines, have placed an order with the Smart-Turner Machine Co., for a duplex pump.

The Plymouth Cordage Works at Welland are nearing completion and will

be in operation by Sept. 15, employing about 450 men.

The Canadian Northern Railway has purchased the Qu'Appelle, Long Lake & Saskatchewan Railroad, giving them access to Regina.

The Peterboro Radiator & Boiler Co. are asking Hastings for a $5,000 bonus and other inducements to locate a factory in that town.

The C.P.R. is to establish a larger repair shop at Medicine Hat and other improvements will be made to the company's plant there.

E. D. Smith has ordered a duplex pump for his new canning factory, Beamsville, from the Smart-Turner Machine Co., Hamilton.

The Smart-Turner Machine Co., Hamilton, Ont., are building a second automatic spike machine for the Hamilton Steel & Iron Co.

The new power plant at Winnipeg, it is said, will be able to deliver power at $16.31. At present the market price is $35 per horse-power.

Winnipeg proposes to establish a municipal power plant and the city engineer is preparing plans for a power plant at Lac du Bonnet.

Wm. R. Webb, Hamilton, has placed an order for a 5-ton hand-power traveling crane with the Smart-Turner Machine Co., Hamilton, Ont.

Marlatt & Armstrong, Oakville, have ordered an automatic feed pump and receiver from the Smart-Turner Machine Co., Hamilton, Ont.

The American Tobbaco Co. have placed an order with the Robb Engineering Co. for a 125 h.p. Corliss engine for their new factory at Montreal.

The Robb Engineering Co. are building for the Hamilton Iron & Steel Co. a 250 h.p. engine for direct connection to a Westinghouse generator.

James J. Hill is said to be planning a canal from Lake Winnipeg to Lake Superior in order to control the grain trade of the Canadian Northwest.

The Smart-Turner Machine Co., Hamilton, Ont., have received an order for a standard duplex pump from the Polson Iron Works, Toronto.

The Superior Cement Co., Orangeville, Ont., have ordered a 200 horse power Robb-Armstrong engine from the Robb Engineering Co., Amherst, N.S.

The Smart Bag Co., of Montreal, are having a three storey factory built for them near Charlevoix on the main line of the Grand Trunk Railway.

Glencoe has carried a by-law to aid the Fletcher Mfg. Co. to the extent of $3,000, the company agreeing to employ at least 25 skilled mechanics.

The Buffalo Tool & Machine Co., dealers in new and second-hand machinery, are negotiating for a site in Toronto on which to build a large warehouse.

The Smart-Turner Machine Co., Hamilton, have received an order for an automatic feed pump and receiver from Maxwell & Johnston, Toronto, Ont.

The SmartTurner Machine Co., Hamilton, are supplying a duplex double-acting power pump, driven by a gasoline engine, to the Sanitarium at Hamilton.

The Brien Heater Co. organized at Welland recently by Niagara Falls men has secured the factory buildings of the Niagara Metallic Furniture Co. at Welland.

John McCullough, of Joliet, Mont., is at the head of a company who will build a 1,000-barrel per day flour mill at Vancouver, B.C., which will cost $100,000.

The Robb Engineering Co. have received an order from Prof. Jas. Robertson for six 150 h.p. boilers for the Macdonald College at St. Anne de Bellevue, Quebec.

Work has commenced on the erection of the new glass factory at Cayuga, and the contract calls for completion of the first building, 54 x 216 feet, within six weeks time.

The Ottawa Electric Co. and the Ottawa Gas Co. have been consolidated. They will hereafter be operated under one management, but with no change of stock.

E. A. Wallberg, Montreal, has secured the contract for the new 132x364 foot steel and concrete car repair shop to be erected at Moncton, N.B., for the Intercolonial Railway.

The Canadian Northern Railway Co. is adding this season 1,500 box cars, 100 flats and 16 new locomotives to the rolling stock equipment of the western end of their system.

The Canadian Northern Railway has closed a contract with J. T. Schell, M.P., for Glengarry, for the construction of a branch from Hawkesbury to Ottawa, a distance of 55 miles.

The hot blast heating system for the storage building of the Terminal Warehouse & Cartage Co., Montreal, P.Q., is being installed by the B. F. Sturtevant Co., of Boston, Mass.

The Canadian Niagara Power Co. announces that there is no demand in Canada for their power and it is their intention to export all the power produced to the United States.

Application has been made for incorporation of the Perth Bolt & Forging Co. This company has acquired the old bolt works property at Perth. The company is capitalized at $50,000.

The Canadian Cutlery Co. are completing arrangements with the City of London for a factory building, offering various inducements, and the company guarantees to employ 100 hands.

Rhodes, Curry & Co., Amherst, N.S., have secured a contract from the Grand Trunk Pacific for 2,500 cars, the value of which will be $2,000,000. The contract is to run over a term of five years.

Evans, Coleman & Evans, Vancouver, B.C. are to establish a cement plant near Kendall, Washington, to supply the increasing demand of the Pacific Coast owing to the rebuilding of San Francisco.

The Federal Electric Co., Brantford, have the contract for the electrical work on the Plymouth Cordage Works at Welland, as well as on about fifty houses which the Plymouth Co. are erecting for their employes

The Chalmers Milling Co., Toronto, have placed an order with W. Gillespie, 98 Front street east, Toronto, for a 65 h.p. Tangye gas engine and a 75 h.p. Dominion gas producer. These will be in operation about September.

The Robbins Irrigation Co. have entered into a contract to spend $1,000,000 on irrigating a tract of land near the Crow's Nest Pass line of the C.P.R. Canning and beet sugar factories will also be established at Medicine Hat.

The Western General Electric Co., Red Deer, Alta., are enlarging their electric lighting plant and have placed an order with the Robb Engineering Co. for a 250 horsepower compound Corliss engine and Robb-Mumford boiler.

A. Berg & Son, lime brick manufacturers, will locate a factory for the production of lime brick in Brantford, Ont. The works will have an initial capacity of 20,000 bricks per day, but there will be facilities for extension to twice that capacity.

The Verity Plow Co. Brantford, are to erect a three storey addition to their warehouse at Brantford at a cost of $3,000, and a large quantity of modern machinery will also be installed in order to allow the capacity of their plant to be doubled.

An automobile company is to be established at Welland by J. F. Mills, of Buffalo. The company agrees to spend $12,000 in plant and employ forty men in return for certain inducements given by the town.

Montreal capitalists are said to be making arrangements to exploit marl deposits on the White Whale Lake Indian Reservation near Edmonton, for the purpose of establishing a large cement plant.

The American Locomotive & Machine Co. have been awarded the contract for the building of 20 locomotives for the G.T.R., ten of which will be built in the Montreal plant and the other ten in Schenectady. The total cost will be $350,000.

The Hamilton Steel & Iron Co. have decided to build their new blast furnace at Hamilton, at a cost of $250,000. It will be completed by 1907, and according to the bargain the company made with the city its total assessment will be $300,000.

Cornwall has passed a by-law giving a bonus of $20,000 and 10 years exemption to the Modern Bedstead Co., of Sherbrooke, Que., who agree to form a

joint stock company with $150,000 capital, and establish a factory to employ 100 or more men.

The Canadian Manufacturers' Association will hold its next convention at Winnipeg, Sept. 17 to 19. About 300 eastern representatives are expected to make a trip to the Pacific Coast over the C.P.R., returning over the Canadian Northern from Edmonton.

Darling Bros., of Montreal, have installed the Canadian Buffalo Down-Draft Forge System in their forge shop. With this system the smoke is thoroughly removed through underground tile pipes, making the forge shop as clean and pleasant as any other workshop.

English capitalists represented in Canada by J. M. MacKinnon, are to develop a pulp industry at Swanson Bay, on the northern coast of British Columbia. Machinery is now being purchased, and preparations made to get the plant in working order as soon as possible.

H. E. Winters, representing an English syndicate, who is in Canada, says his concern will probably erect three factories, one in Cape Breton, another near Parry Sound, and a third in British Columbia, where "Ammonal," a powerful explosive for use in railway construction, will be manufactured.

The Niagara Falls Machine & Foundry Co. have secured the contract for the grey iron castings to be used in building the furnaces and also for the ingot molds and pits for the Ontario Iron & Steel Co., at Welland. Between three and four hundred tons of castings will be used in the erection of the furnaces.

Contracts have been closed by an influential grain firm with the Northern Construction Co., Winnipeg, for the erection of 10 to 15 modern grain elevators to be ready for the handling of this season's crop. This firm has also commenced the erection of a large storage elevator in Point Douglas for the Canada Paint Co.

The South African Parliament is considering a preferential law allowing rebates on certain classes of goods imported from Canada. Manufactured articles, manufactured iron or steel, cement, etc., are to be subject to a rebate of 3 per cent., and this will go a long way towards paying shipping rates to the Cape.

Beatty & Sons, Welland, Ont., manufacturers of contractor's machinery, having found their present plant much too small for their rapidly growing business, are erecting a new plant which will have a capacity of about three times their present one. The new works are on the banks of the Welland Canal and will have a railroad siding running into them. The new plant will be ready by January, 1907.

Evidences are not wanting that many more saw mills will be built in the course of the coming year in the coast section of B.C. On the Fraser River, near New Westminster, especially, the purchase of water frontage which is adaptable for saw mills has been very active. Eastern and American capital has been investing, and several announcements have been made of projected mills, of which construction may be begun in the near future.

The recently organized Supreme Heating Co. may decide to locate their proposed stove foundry at Toronto Junction, although Owen Sound is the headquarters of the company. The company will manufacture stoves with attachments whereby a complete combustion is claimed to be produced and a large saving on fuel made. The device was patented by W. R. Hampden, recently of San Francisco.

The Kemp Manure Spreader factory, Stratford, owned by the Massey-Harris Co., will be re-opened in the Fall as a binder twine factory. The Massey-Harris Co., unlike the large American implement manufacturers in the United States, has never engaged in the manufacture of binder twine, they buying their supply from the established manufactories. It has now been decided to make their own supply and the Stratford buildings of the company are to be fitted up for the purpose. This will necessitate the installation of a large amount of new machinery.

Orders for a large proportion of the machinery intended for the pulp mill of the Canadian Pacific Sulphite Co., at Swanson Bay, up the coast, have been placed by J. M. Mackinnon, the managing director. A big logging outfit will also be put in to get out logs for the timber necessary to be used in the construction of the mill. The company will build, equip and operate its own saw mill. Two leading members of the company, which is almost entirely British in personnel, Messrs. E. E. Sawyer and John Yale, are now en route to British Columbia to take active superintendence of the work in conjunction with Mr. Mackinnon. All of the members of the company are well-known in financial circles in London.

Thos. Ahearn, president of the Ottawa Car Co., says that negotiations with the Coventry Ordnance Works for the establishment of a factory near Ottawa for the manufacture of heavy guns, are well advanced. His partner, Mr. Soper, returned from England last Monday, where he had been conducting negotiations. The fact of the car company having made many gun and ambulance wagons for the Imperial authorities has encouraged them to embark upon the wider field. The Coventry concern will establish itself in Canada only on condition of the Dominion Government giving a guarantee that all new guns required for the Canadian batteries will be obtained from their Canadian factory.

The Canadian Pacific Railway is preparing to construct a steel bridge across the Belly River, at Lethbridge, which will be one of the largest, if not actually the most extensive bridge, of its kind in the world. It will be one mile in length and 300 feet high, and will be a double bridge with the railway track on the top. Its construction will enable the company to shorten the mileage between Lethbridge and Macleod, as well as to lower the grade, enabling heavy loads to be carried at less cost. Owing to the steel works being so rushed with orders at present it is thought that it will be impossible to obtain the structural material for delivery this season, but the masonry will be proceeded with at once so as to have it in readiness for the girders next year.

* * *

The Labatt Manufacturing Co.

The Canadian Brass & Supply Co., London, Ont., have changed their name to the Labatt Manufacturing Co., with head offices and factory at London and branch offices in Toronto and Winnipeg.

Entirely new equipment has been purchased for the plant, and besides plumbers' supplies the company will now manufacture power and waterworks machinery on a large scale.

The Toronto office has been moved to 367 Queen street west, to provide greater accommodation than the former premises allowed.

* * *

New Plant of the Canadian McVicker Engine Co.

The Canadian McVicker Engine Co., Limited, has been organized in Galt to build the McVicker gas and gasoline engine in Canada. This company will be associated with the Alma Manufacturing Co., Alma, Mich., which was organized some four years ago to build engines on the McVicker patents. This company has now a capitalized stock of $300,000. The Canadian company is capitalized at $100,000, all paid up, and it is expected that within a year this will be increased.

The company has four acres of ground situated on the C.P.R. and Grand Trunk tracks, on which there is now a machine shop built, 48x83 feet, equipped with over $20,000 worth of the latest machine tools and equipment necessary for the manufacture of gas engines, besides which there are the storage building, 30x65 feet, the assembling shop, 30x100 feet, the office building, 22x32 feet, and the pattern and pattern storage building, 30x50 feet, all of which are now nearing completion. The company also have in prospect a finishing and testing shop, 30x100 feet, a foundry building, 50x100 feet, a traction engine machine shop, 50x100 feet, and a traction engine assembling and storage building, 50x100 feet.

The company will at present build engines in sizes from 2 h.p. to 100 h.p., but will ultimately be building in sizes up to 1,000 h.p. In the Fall it is proposed to start the manufacture of double cylinder gasoline traction engines.

A full description of the new plant of the Canadian McVicker Engine Co., together with illustrations, will appear in a subsequent issue of Canadian Machinery.

* * *

New Plant of S. F. Bowser.

S. F. Bowser & Co., manufacturers of self-measuring oil outfits, Toronto, have awarded a contract for the construction of a large new office and factory building on Fraser street, Toronto. It will be a two-storey brick building with basement, 50 x 125 feet. The office and machine shop will be on the first floor

and the finishing department on the second. The machine shop will be driven by individual motor drive, power being generated by steam at the plant. There will be a siding run into the building from the C.P.R.

* * *

Canadian Branch of Berlin Co.

Arrangements have been made whereby the Berlin Co., Beloit, Wis., large manufacturers of wood-working machinery, will establish a branch of their works in Hamilton, Ont. A Canadian company will be formed with a capital of about half a million, of which considerable will be Hamilton investment. A ten-acre site has been chosen and as soon as the company is incorporated building operations will be commenced. Buildings now projected are of the following dimensions: 360 x 50 feet, 250 x 72 feet, 100 x 30 feet, 200 x 20 feet, 80 x 40 feet, and 200 x 180 feet. About 200 men will be employed at the start.

* * *

McGregor, Gourlay Additions.

The foundations of the additions to be made to the plant of the McGregor, Gourlay Co., Galt, Ont., have now been started. One of the additional buildings, 210 x 140 feet, is to be used as a molding shop. The construction is steel, concrete and brick. This building will be equipped with electric traveling cranes and pneumatic tools. The other addition will be a three-storey warehouse building, 204 x 55 feet. These additions will allow the present molding shop and warehouse to be fitted up as an additional machine shop. The company are also installing a new electric power plant and, as far as possible the system of drive throughout the manufacturing section will be independent electric motor.

* * *

Rating of Gas Engines.

In regard to the editorial entitled "Rating of Gas Engines," which appeared in the July issue of Canadian Machinery, the Canadian Fairbanks Co. have written advising us that the Fairbanks-Morse engine, which is now being made in Canada, is subjected to a brake test before it leaves the factory lasting from three or four days to two weeks, and it is rated according to brake horse-power, and not indicated horse-power, and they guarantee that all the engines will develope more than their rated horse-power.

Rating engines according to brake horse-power is the only satisfactory method, and firms using this system are to be commended, while its adoption by all Canadian manufacturers, should be strongly advocated, because only when the system is general will the purchaser be certain of securing exactly what he wishes. Should Canadian gas engine manufacturers as a whole adopt the brake horse-power method of rating it would be a step towards further raising the standard of gas engine manufacture in Canada, and making gas power a still keener competitor of steam and electric power. It would be a means towards increasing the reliability of the gas engine, and would thus assist in breaking down the wall of prejudice which still exists in the minds of many power users against the internal combustion motor.

* * *

Manufacturing New Machinery.

I. E. Shantz & Co., Berlin, Ont., are developing new hand and power pipe threading machines, which the company claim will embody distinctly new ideas along this line. These machines will be exhibited by the company at the Canadian National Exhibition, Toronto, in September.

Descriptions and illustrations of these machines will appear in a later issue of Canadian Machinery, as soon as the machines are sufficiently far developed to warrant photos being taken of them.

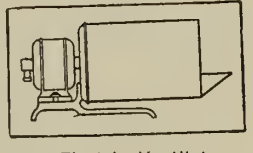
* * *

Addition to Plant of Clark & Demill.

The addition to the plant of Clark & Demill, Hespeler, Ont., has now been completed, and the new machinery installed. This firm manufactures all classes of wood-working machinery and this addition to their plant will greatly increase their facilities for handling their rapidly increasing business.

ELECTRIC VENTILATOR.

A recently invented electric ventilator is operated by a small electric motor contained in the case, with the fan. Air is drawn in through a screen which removes all dust and dirt, and on entering the ventilator strikes a basin of water which cools and moistens the air. For sick rooms small pieces of ice can be put in the water or any desired disinfectant. If dry air is desired instead of the water or ice, use lime, which is a rapid absorber of moisture.



Electric Ventilator.

THE USE OF CONCRETE.

Practically speaking, Canadians have merely begun to realize the importance of reinforced concrete for construction purposes, and in spite of the amount of literature published on the subject, there are many, even in the building trade, who do not understand its application.

In a recent interview, Henry Holgate, vice-president of the Dominion Engineering & Construction Co., and one of the acknowledged Canadian authorities on the use of concrete, gave some interesting information in this regard, which is herewith repeated:

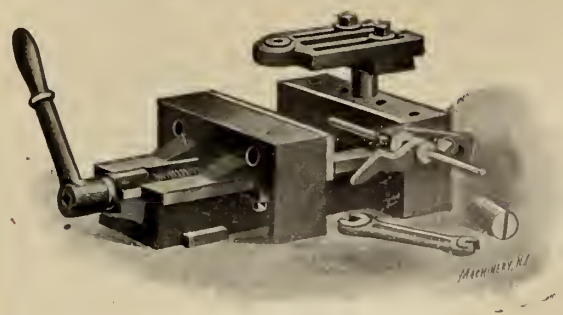
"The extensive use of reinforced concrete," said he, "is a matter of such recent growth in Canada that it is no wonder that the public has not grasped the full significance of its adoption in important structural enterprises. It is only a question of time, however, when its qualities will be as well known as those of brick or stone, which materials it is fast supplanting for building purposes wherever its advantages are appreciated.

"Concrete is composed of cement, sand and gravel or crushed stone. As cement is easily available, and as sand and gravel abound, it follows that concrete can be advantageously made in any part of the country. As concrete possesses in itself great power to withstand compression stresses, it has proved of tremendous value in building canals, retaining walls, and all manner of construction work where it is not subjected to great tensile stresses. When a structure is designed to meet tensile stresses, like a skyscraper or a large factory, it becomes necessary to use in connection with the concrete some materials capable of taking up this additional burden. Steel does this to the best advantage, and when employed in conjunction with the concrete, furnished the combination known as 'reinforced concrete.'

"Concrete alone is cheaper than stone or brick, but steel is extremely expensive, so that the problem confronting the man who designs a structure of reinforced concrete is how to use the minimum of steel and yet get out of it the maximum of strength. He aims to distribute his reinforcing rods in such a way that each will supplement the other and all will supplement the concrete. If he does this successfully he produces a monolithic structure in which every strain and stress, no matter how great, is distributed through and borne by the whole.

"As soon as architects, engineers and contractors began to use reinforced concrete for complicated work, numerous methods of reinforcement were invented. All these methods aim to increase the load-bearing power of the concrete and to insure accuracy of construction, and all have their advocates. It can not be doubted, however, that the best mode of procedure is to design the reinforcement not only so that it will fill its own function efficiently, but so that it will contribute its proper part toward strengthening the structure as a unit.

"It goes without saying that skill and experience in the use of reinforced concrete are requisites without which no successful structure of this kind can be either designed or erected. Not only must the design be without flaw, but the actual construction work must be done under the closest supervision to insure reliability. The reinforced concrete structure once successfully completed will stand practically forever, for the older concrete grows the harder it becomes. One of its most important attributes is its resistance to fire. To all intents it is fireproof. Steel is not, but imbedded in concrete steel is so well protected that the combination, or reinforced concrete, is as fireproof as concrete alone. This was the great lesson taught by the San Francisco disaster and by the Baltimore fire. The fire-resisting quality of concrete carries its own sequel; insurance rates on concrete structures are so low as to be almost negligible. In connection with its use with steel, concrete has another remarkable and unique advantage; it protects the steel absolutely from rust — something that no other material yet discovered has been able to do."



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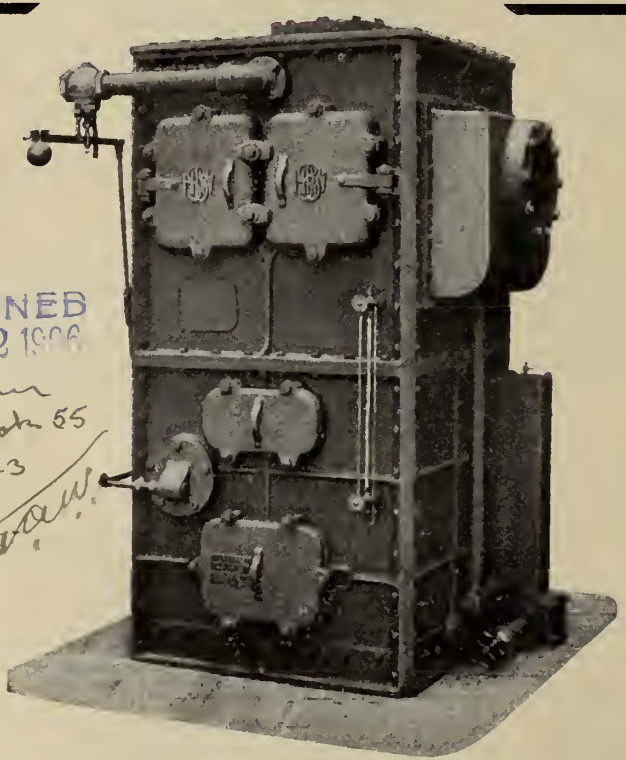

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PERSONAL MENTION.

Mr. J. C. Royce, S.B., consulting engineer, Toronto, is at present in Europe investigating the recent development of the gas engine and producer gas plant, and also the independent motor drives for railway cars now in use on some of the English railways. Mr. Royce sailed for England on July 6, and will probably visit France and Germany before returning to Canada towards the end of August.

Mr. D. M. Murray, of the Chapman Double Ball Bearing Co. of Canada, Toronto, is away on a month's business trip to Quebec and the Maritime Provinces.

CONTENTS

Modern Canadian Manufacturing Plants 291
New Plant of Chadwick Bros., Hamilton, Ont.

The Canadian Fairbanks Co's Warehouse 294

Edmonton's Call for Factories..... 295

Editorial 298
The Fight for Blue Sky.
Splendid Crop Prospects.
July Metal Failures.
Machine Tool Situation.
Canadian Trade with United States.

Electro-Thermic Smelting Experiments 300

Belting and Transmission of Power.301
By C. Charles Maison, E.E.

Milling Cutters 303
Article IV. By John Edgar.

Foundry Practice 305
Uniform Practice in Foundry Cost Finding.
Modern Foundry Construction.
Manufacture of Soil Pipe and Fittings.

Mechanical Reviews 308
Fitting Curved Work.
Milling in the Lathe.
Banking a Cupola.
Practical Data on Suction.
Gas Producers.

Tricks of the Trade 310
Punch and Die Strippers.
Equipment for Machine Tools.

Power and Transmission 312
Canadian Buffalo Forge Turbine Pump.
Sturtevant Horizontal Engine.

Engineering News 315
Excursion of the Engineer's Club.
Railroad and Contractors' Supplies.

Machinery Development.... 316
Small "Bliss" Power Press.
New Slag Car.
Allis-Chalmers Hundred-Ton Flat Car.

About Catalogues 318

Practical Questions and Answers.. 319

The Need of a Practical Education 320
By Thomas D. West.

At the Noon Hour 321

Companies Incorporated 323

Industrial Progress 324

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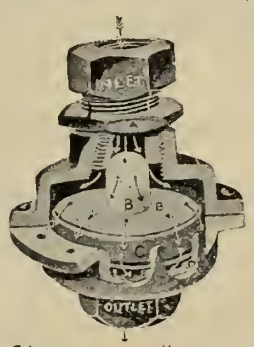

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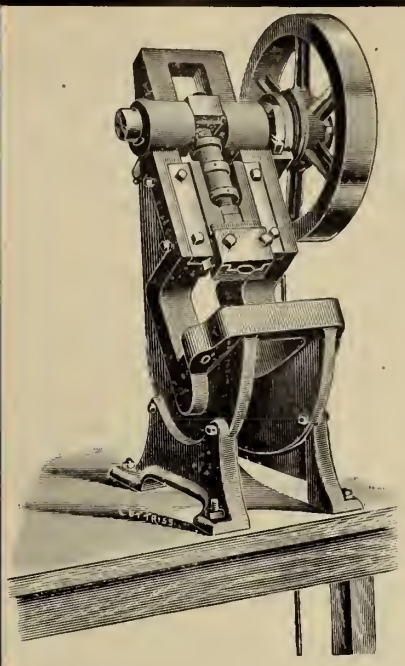

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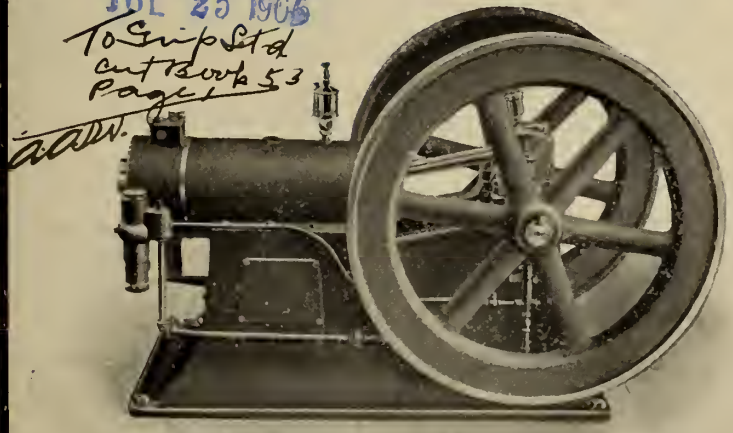

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Boynton & Plummer, Worcester, Mass.
Canadian Buffalo Forge Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.

Drills, Blacksmith.

Boynton & Plummer, Worcester, Mass
Canadian Buffalo Forge Co , Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg., Co., St. Catharines.

Drills, Centre.

Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
L. S. Starrett Co., Athol, Mass.

Drills, Electric

B. F. Barnes Co,, Rockford, Ill.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drills, Gang.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Pratt & Whitney Co., Hartford, Conn.

Drills, High Speed.

Wm. Abbott, Montreal.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Whitman & Barnes Mfg. Co., St. Catharines.

Drills, Hand.

Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.

Drills, Horizontal.

B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drills, Jewelers.

Pendrith Machinery Co., Toronto.

Drills, Pneumatic.

Chicago Pneumatic Tool Co , Chicago.
Niles-Bement-Pond Co., New York

Drills, Radial.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drills, Ratchet.

Armstrong Bros. Tool Co , Chicago.
A. B. Jardine & Co., Hespeler,
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg., Co , St. Catharines.

Drills, Rock.

Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Drills, Sensitive.

American Tool Works Co., Cincinnati.
B. F. Barnes Co , Rockford, Ill.
Niles-Bement-Pond Co., New York

Drills, Shop View.

John Bertram & Sons Co., Dundas, Ont.

Drills, Twist.

Chicago Pneumatic Tool Co., Chicago.
Alex. Gibb, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co , New Bedford, Mass.
New Process Twist Drill Co., Taunton, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

Drying Apparatus of all Kinds.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Dump Cars.

Dominion Henderson Bearings, Limited, Toronto.
Hamilton Facing Mill Co., Hamilton.
Jenckes Machine Co., Sherbrooke, Que
Link-Belt Eng. Co., Philadelphia.
Waterous Engine Co., Brantford.

Dust Separators.

Canadian Buffalo Forge Co. Montreal.
McEachren Heating and Ventilating Co., Galt. Ont.
Sheldon's Limited, Galt, Ont.

Dynamos.

Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
D'Olier Engineering Co., New York.
Packard Electric Co., St. Catharines.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Dynamos—Turbine Driven.

Kerr-Turbine Co., Wellsville, N.Y.

Economizer, Fuel.

Canadian Buffalo Forge Co., Montreal.
Dominion Henderson Bearings, Limited, Toronto.
McEachren Heating and Ventilating Co., Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Man.

Electrical Instruments.

Canadian Westinghouse Co., Hamilton.

Electrical Supplies.

Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Loudon Mach. Tool Co., Hamilton, Ont.
Packard Electric Co., St. Catharines.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Eectrically-Driven Tools and Machinery.

American Tool Works Co., Cincinnati.
John Bertram & Sons, Dundas.
Canada Machinery Agency, Montreal.
Canadian Westinghouse Co., Hamilton.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Electrical Repairs

Canadian Westinghouse Co., Hamilton.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Emery and Emery Wheels.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Emery Wheel Dressers.

Diamond Saw & Stamping Works, Buffalo
Dominion Foundry Supply Co , Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.
H. W. Petrie, Toronto.
Standard Tool Co., Cleveland.

Emery Wheel Dressers, Cutters.

Diamond Saw & Stamping Works, Buffalo.

Engineers and Contractors.

Canadian White Co., Montreal.
D'Olier Engineering Co., New York.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Link-Belt Eng. Co., Philadelphia.
The Smart-Turner Mach. Co., Hamilton.

Engineers' Supplies.

Rice Lewis & Son, Toronto.

Engines, Gas and Gasoline.

The Canadian Fairbanks Co., Montreal.
Canadian McVicker Engine Co., Galt, Ont
Dominion Henderson Bearings, Limited. Toronto.
Economic Heat, Light and Power Supply Co , Toronto.
W. Gillespie, Toronto.
The Goldie & McCulloch Co., Galt, Ont.
International Harvester Co., Chicago
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.

Engines, Steam.

Allis-Chalmers-Bullock. Montreal.
Canadian Buffalo Forge Co., Montreal.
D'Olier Engineering Co., New York.
The Goldie & McCulloch Co., Galt, Ont.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
John McDougall Caledonian Iron Works, Montreal.
Laurie Engine & Machine Co., Montreal.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.
Waterous Engine Works Co., Brantford.

Engravers.

Toronto Engraving Co., Toronto.

Exhaust Heads.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Out.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Expanded Metal.

Expanded Metal and Fireproofing Co. Toronto

Expanders.

A. B. Jardine & Co., Hespeler, Ont.

Fans, Electric.

Canadian Buffalo Forge Co., Montreal.
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Fans, Exhaust.

Canadian Buffalo Forge Co., Montreal.
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.
McEachren Heating and Ventilatiug Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass

Feed Water Heaters.

The Smart-Turner Mach. Co., Hamilton.

Files and Rasps.

Rice Lewis & Son, Toronto.
Nicholson File Co., Providence, R.I.
H. W. Petrie, Toronto.
Whitman & Barnes Mfg. Co., St. Catharines.

Fillet, Pattern.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co , Hamilton

Fire, Apparatus.

Waterous Engine Works Co., Brantford.

Fire Brick and Clay.

Dominion Foundry Supp'y Co., Montreal and Toronto
Hamilton Facing Mill Co., Hamilton.

Flash Lights.

Berlin Electrical Mfg. Co., Berlin, Ont.

Flour Mill Machinery.

Allis-Chalmers-Bullock Co., Montreal.
The Goldie & McCulloch Co., Galt, Ont.
Ottawa Steel Castings Co., Ottawa.

Flue Rollers.

Chicago Pneumatic Tool Co., Chicago.

Forges.

Boynton & Plummer, Worcester, Mass.
Canadian Buffalo Forge Co., Montreal.
Hamilton Facing Mill Co., Hamilton.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Forgings, Drop.

H. W. Petrie, Toronto.
St. Lawrence Supply Co., Montreal.
Whitman & Barnes Mfg. Co., St. Catharines.

Forging Machinery.

John Bertram & Sons Co , Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio
Niles-Bement-Pond Co., New York.
Western Machine Co., Stouffville, Ont.

Founders.

R. McDougall Co., Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
Western Machine Co., Stouffville, Ont.

Friction Clutch Pulleys, etc.

The Dodge Mfg. Co., Toronto.
The Goldie & McCulloch Co., Galt, Ont.
Link-Belt Eng. Co., Philadelphia.
McLean & Sophus, Montreal.
Ottawa Steel Castings Co., Ottawa.
Sylvester Mfg. Co., Lindsay, Ont.

Furnaces.

Dominion Foundry Supply Co , Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Gas Blowers and Exhausters.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
D'Olier Engineering Co., New York.
B. F. Sturtevant Co., Hyde Park, Man.

Gas Plants, Suction.

Dominion Henderson Bearings, Limited, Toronto.
Economic Heat, Light and Power Supply Co., Toronto.
W. Gillespie, Toronto.
Sylvester Mfg. Co., Lindsay, Ont.
Wayland Williams & Dadson, Montreal.
Western Machine Co., Stouffville, Ont.

Gauges, Standard.

Brown & Sharpe, Providence, R.I.
McLean & Sophus, Montreal.
Pratt & Whitney Co., Hartford, Conn.

Gear, Cutting Machinery.

Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cincinnati.
Brown & Sharpe, Providence, R.I.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford. Con
Williams & Wilson, Montreal.

Gears, Angle.

Brown & Sharpe, Providence, R.I.
Chicago Pneumatic Tool Co., Chicago.
Laurie Engine & Machine Co., Montreal.
Ottawa Steel Castings Co., Ottawa.
Waterous Engine Co., Brantford.

Gears, Reducing.

Brown & Sharpe, Providence, R.I.
Chicago Pneumatic Tool Co., Chicago.
Ottawa Steel Castings Co., Ottawa.

Generators, Electric.

Allis-Chalmers-Bullock, Montreal.
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.
D'Olier Engineering Co., New York.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.

Generators, Gas.

H. W. Petrie, Toronto.

Glass Bevelling Machines.

Pendrith Machinery Co., Toronto.

Graphite.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Grinders, Centre.

Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinders, Cutter.

Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.
Wilmarth & Morman C., Graud Rapids, Mich.

Grinders, Reamer.

Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Drill.

Wilmarth & Morman, Grand Rapids, Mich.

Grinders, Tool.

Armstrong Bros. Tool Co., Chicago.
B. F. Barnes Co., Rockford, Ill.
Brown & Sharpe, Providence, R.I.
H. W. Petrie, Toronto.
The Stevens Co., Galt, Ont.
Williams & Wilson, Montreal.
Wilmarth & Morman, Grand Rapids, Mich

Grinding Machines.

Brown & Sharpe, Providence, R.I.
The Canadian Fairbanks, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Wilmarth & Morman, Grand Rapids, Mich.

Grinding and Polishing Machines.

The Canadian Fairbanks Co., Montreal.
Dominion Henderson Bearings, Limited, Toronto.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Wilmarth & Morman, Grand Rapids, Mich.
Pendrith Machinery Co., Toronto.

Hack Saws.

The Canadian Fairbanks Co., Montreal.
Niles-Bement-Pond Co., New York.
McLean & Sophus, Montreal.
H. W. Petrie, Toronto.
West Haven Mfg. Co., New Haven, Conn.
Williams & Wilson, Montreal.

Hammers, Drop.

London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Poud Co., New York.

Hammers, Rand—All Kinds.

Whitman & Barnes Mfg. Co., St. Catharines.

Hammers, Steam.

John Bertram & Sons Co. Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Hangers.

Dominion Henderson Bearings, Limited, Toronto.
The Goldie & McCulloch Co., Galt, Ont.
Ottawa Steel Castings Co., Ottawa.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford.
Pendrith Machinery Co., Toronto.

Heating Apparatus.

Canadian Buffalo Forge Co., Montreal
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., High Park, Mass.

Hoisting and Conveying Machinery.

Allis-Chalmers-Bullock, Montreal.
Jenckes Machine Co., Sherbrooke, Que.
Link-Belt Eng. Co., Philadelphia.
Niles-Bement-Pond Co., New York.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford,

Hoists, Pneumatic.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co. Chicago.
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Hose, Air.

Canadian Rand Drill Co., Montreal.
Canadian Westinghouse Co., Hamilton.
Chicago Pneumatic Tool Co. Chicago.

Hose Couplings.

Canadian Rand Drill Co., Montreal.
Canadian Westinghouse Co., Hamilton.
Chicago Pneumatic Tool Co., Chicago.
Whitman & Barnes Mfg. Co., St. Catharines.

Hose, Steam.

Canadian Rand Drill Co., Montreal.
Canadian Westinghouse Co., Hamilton.
Allis-Chalmers-Bullock, Ltd., Montreal.

Hydraulic Accumulators.

Niles-Bement-Pond Co., New York.
The Smart-Turner Mach. Co., Hamilton.

Hydraulic Machinery.

Allis-Chalmers-Bullock Co., Montreal.
Niles-Bement-Pond Co., New York.
Allis-Chalmers-Bullock, Ltd Montreal.

Indicators, Speed.

L. S. Starrett Co., Athol, Mass.

Injectors.

Canada Foundry Co., Toronto.
The Canadian Fairbanks Co., Montreal.
Rice Lewis & Son, Toronto.
Penberthy Injector Co., Windsor, Ont.

Iron Filler.

Dominion Foundry Supply Co. Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Iron Tools.

John Bertram & Sons Co., Dundas, Ont.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
H. W. Petrie, Toronto.
The Stevens Co., Galt, Ont.

Key-Seating Machines.

B. F. Barnes Co., Rockford, Ill.
Niles-Bement-Pond Co., New York.

Lace Leather.

Sadler & Haworth, Montreal.

Lamps, Arc and Incandescent.

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The Packard Electric Co., St. Catharines.

Lathe Dogs.

Armstrong Bros., Chicago
Ottawa Steel Castings Co., Ottawa.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Engine.

American Tool Work Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
R. McDougall Co., Galt, Ont.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.

Lathes, Foot-Power.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.

Lathes, Screw Cutting.

B. F. Barnes Co., Rockford, Ill.
Niles-Bement-Pond Co., New York.

Lathes, Automatic, Screw-Threading.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Bench.

B. F. Barnes Co., Rockford, Ill.
London Mach. Tool Co., London, Ont.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Turret.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
R. McDougall Co., Galt, Ont.
The Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.
Warner & Swasey Co., Cleveland, O.

Lathes, Buffing and Polishing.

Pendrith Machinery Co., Toronto.

Lathes, Metal Spinning.

Pendrith Machinery Co., Toronto.

Leather Belting.

The Canadian Fairbanks Co., Montreal.
The Dodge Mfg. Co., Toronto.

Locomotives, Air.

Canadian Rand Drill Co., Montreal.

Locomotives, Electrical.

Canadian Westinghouse Co., Hamilton

Locomotives, Steam.

Canada Foundry Co., Toronto.
Canadian Rand Drill Co., Montreal

Lubricator, Plumbago.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Lumber Dry Kilns.

Canadian Buffalo Forge Co., Montreal
McEachren Heating and Ventilating Co., Galt, Ont.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park Mass.

Machinery Dealers.

The Canadian Fairbanks Co., Montreal.
Dominion Henderson Bearings, Limited, Toronto.
Ottawa Steel Castings Co., Ottawa.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
St. Lawrence Supply Co., Montreal.
Williams & Wilson Montreal.

Machinery Designers.

Dominion Henderson Bearings, Limited, Toronto.

Machinists.

W. H. Banfield & Sons, Toronto.
The Dodge Mfg. Co., Toronto.
Dominion Henderson Bearings, Limited, Toronto.
Link-Belt Eng. Co., Philadelphia.
Ottawa Steel Castings Co., Ottawa.
Pendrith Machinery Co., Torenta.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford.

Machinists' Small Tools.

Armstrong Bros., Chicago.
Brown & Sharpe, Providence, R.I.
Butterfield & Co., Rock Island, Que.
Rice Lewis & Son, Montreal.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
L. S. Starrett Co., Athol, Mass.
Williams & Wilson, Montreal.

Mailing Weights.

A. B. Jardine & Co., Hespeler, Ont.

Mandrels.

Brown & Sharpe, Providence, R.I.
A. B. Jardine & Co., Hespeler, Ont.
The Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg. Co., St. Catharines.

Measuring Machines.

The Pratt & Whitney Co., Hartford, Conn.

Mechanical Draft.

Canadian Buffalo Forge Co., Montreal.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Meters, Electrical.

Canadian Westinghouse Co., Hamilton.
Allis-Chalmers-Bullock, Ltd., Montreal.

Mill Machinery.

The Dodge Mfg. Co., Toronto.
The Goldie & McCulloch Co., Galt, Ont.
Jenckes Machine Co., Sherbrooke, Que.
Ottawa Steel Castings Co., Ottawa.
H. W. Petrie, Toronto.
Waterous Engine Co., Brantford.
Williams & Wilson, Moutreal.

Milling Attachments.

Becker-Brainard Milling Machine Co. Hyde Park, Mass.
John Bertram & Sons Co.. Dundas. Ont.
Brown & Sharpe, Providence, R.I.
Niles-Bement-Pond Co., New York,
Pratt & Whitney, Hartford, Conn.
The Stevens Co., Galt, Ont.

Milling Machines, Horizontal.

Becker-Brainard Milling Machine Co., Hyde Park, Mass.
John Bertram & Sons Co., Dundas, Ont.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
Pratt & Whitney, Hartford, Conn.

Milling Machines, Plain.

American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co. Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Milling Machines, Universal.

American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Milling Machines, Vertical.

Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Milling Tools.

Wm. Abbott, Montreal.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
Dominion Henderson Bearings, Limited, Toronto.
Geometric Tool Co., New Haven, Conn.
London Mach. Tool Co., Hamilton, Ont.
Ottawa Steel Castings Co., Ottawa.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
The Stevens Co., Galt, Ont.

Mining Machinery.

Allis-Chalmers-Bullock, Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
The Dodge Mfg. Co., Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Ottawa Steel Castings Co. Ottawa.
T. & H. Electric Co. Hamilton.

Mixing Machines, Dough.

Pendrith Machinery Co., Toronto.

Mixing Machines, Special.

Pendrith Machinery Co., Toronto.

Model Tools.

Dominion Henderson Bearings, Limited, Toronto.
The Stevens Co., Galt, Ont.
Wells Pattern and Model Works, Toronto

Motors, Electric.

Allis-Chalmers-Bullock Co., Montreal.
Canadian General Electric Co., Torouto.
Canadian Westinghouse Co., Hamilton.
The Packard Electric Co., St. Catharines.
B. F. Sturtevant Co., Hyde Park, Man.
T. & H. Electric Co., Hamilton.

Motors, Air.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Molders' Supplies.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Molders' Tools.

Hamilton Facing Mill Co., Hamilton.
Dominion Founury Supply Co., Montreal and Toronto.

Molding Sand.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Nippers, Stay Bolt.

Chicago Pneumatic Tool Co., Chicago.

Nut Tappers.

John Bertram & Sons Co., Dundas, Ont
A. B. Jardine & Co., Hespeler.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.

Oatmeal Mill Machinery.

The Goldie & McCulloch Co., Galt

Oils, Core.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Painting Machines, Pneumatic.

Chicago Pneumatic Tool Co., Chicago.

Patent Solicitors.

Hanbury A. Budden, Montreal.
Fetherstonhough & Blackmore, Montreal
Fetherstonhough & Co., Montreal.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

Patterns.

John Carr, Hamilton.
The Dodge Mfg. Co., Toronto.
Hamilton Pattern Works, Hamilton
Ottawa Steel Castings Co., Ottawa.
The Stevens Co., Galt, Ont.
Wells' Pattern and Model Works, Toronto.

Pipe Cutting and Threading Machines.

Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
R. McDougal Co., Galt, Ont.
Niles-Bement-Pond Co., New York.

Planers, Portable.

H. B. Underwood Co., Philadelphia.

Planers, Standard.

American Tool Works, Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
The Canadian Fairbanks Co., Montreal.
Loudon Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Planers, Rotary.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Power Plants.

The Smart-Turner Mach. Co., Hamilton.

Planing Mill Fans.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Man.

Plug Drillers, Pneumatic.

Canadian Rand Drill Co., Montreal.

Plumbago.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Pneumatic Tools.

Allis-Chalmers-Bullock Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago
Hamilton Facing Mill Co., Hamilton.

Presses, Drill.

American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.

Presses, Drop.

W. H. Banfield & Son, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Niles-Bement-Pond Co., New York

Presses, Hand.

E. W. Bliss Co., Brooklyn, N.Y.

Presses, Hydraulic.

Jenckes Machine Co., Sherbrooke, Que.
John Bertram & Sons Co., Dundas, Ont.
Laurie Engine & Machine Co., Montreal.
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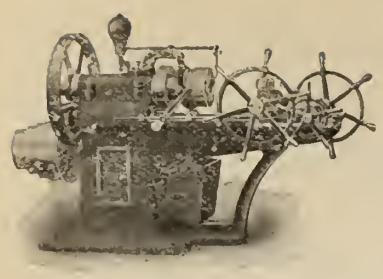

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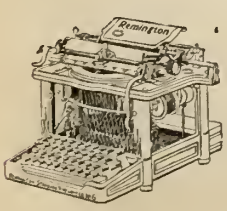

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ALPHABETICAL INDEX.

A

Abbott, Wm. 74
Albany and North River Moulding sand Co. 19
Allis-Chalmers-Bullock Co. ..... Outside back cover
American Tool Works Co 5
Armstrong Bros. Tool Co. 75

B

Barnes, B. F., Co. 6
Banfield, W. H., & Sons 72
Becker-Brainard Milling Machine Co.. 6
Berlin Electrical Mfg. Co. 15
Bertram, John, & Sons ..... front cover
Bickford Drill & Tool Co. 4
Bliss, E. W., Co 6
Boynton & Plummer 79
Brandeis, Charles. 65
Brown, Boggs & Co 61
Brown & Sharpe Mfg. Co. 7
Budden, Hanbury A. 65
Butterfield & Co. 78

C

Canada Foundry Co. 59
Canadian Pneumatic Tool Co 78
Canada Chemical Mfg. Co. 15
Canadian Buffalo Forge Co. 17
Canadian Fairbanks Co. 20
Canagian McVicker Engine Co 61
Canadian Rand Drill Co. 75
Canadian Westinghouse Co. 1
Carr, John 66
Chadwick Bros 73
Chapman Double Ball-Bearing Co. 10
Clsrk-Demill Co. 73
Cleveland Automatic Mach. Co. 17

D

DeCew, J. A. 65
Detroit Testing Laboratory. 65
Diamond Saw and Stamping Works ... 79
Dillon A., & Son. 66
Dodge Mfg. Co 11
Dominion Foundry Supply Co 72
Dominion Henderson Bearings 10
D'Olier Engineering Co. 15
Dominion Belting Co. 74

E

Economical Mfg. and Supply Co 15
Economic Power, Light and Heat Supply Co 71
Electric Blue Print Co. 65
"Electrical Times" 66
"Engineering" 66
Engineering Specialties Co 53
"Engineering Times". ..... inside back cover
Expanded Metal and Fireproofing Co. 74

F

Fetherstonhaugh & Co. 65
Fetherstonhaugh & Blackmore. 65
Fielding, John S. 65

G

Gibb. Alex 76
Gillespie, W. 71
Geometric Tool Co. 79
Goldie & McCulloch Co. 1
Greening, B., Wire Co. 14

H

Hamilton Facing Mills Co 73
Hamilton Pattern Works 66
Howard, Geo. H. 17

I

International Harvester Co. 70

J

Jardine, A. B., & Co. 72
Jenckes Machine Co. 14
Jessop, Wm., & Sons 74

K

Ker & Goodwin 72
Kerr Turbine Co. 12

L

Laurie Engine and Machine Co. 12
Leonsrd, E., & Son. 72
Lewis, Rice, & Son. 80
Link-Belt Eng. Co 14
London Machine Tool Co. 2

M

McDougall, R., Co 4
McDougall, John, Caledonian Iron Wks 13
McEachern Heating & Ventilating Co. 17
McLachlan Gasoline Engine Co. 72
Marion & Marion 65
Merrell Mfg. Co. 7
Morrow, John, Machine Screw Co. 74
Morse Twist Drill and Machine Co.... 16

N

National Machinery Co. 66
New Process Twist Drill Co. 76
Nicholson File Co. 74

O

Osborn Mfg. Co. 73
Otis-Fensom Elevator Co. inside back cover
Ottawa Steel Castings Co 59

P

Packard Electric Co. ..... inside back cover
Parke, Roderick J. 65
Penberthy Injector Co. 73
Pendrith Mach. Co. 58
Petrie, H. W 9
Potter & Johnston Machine Co. 17
Pratt & Whitney Co. ..... iuside front cover
Pringle, T., & Son 65

R

Remington Typewriter Co. 66
Ridout & Maybee. 65
Rohb Engineering Co. 13
Royce, James C. 65

S

Sadler & Haworth. 67
Sheldons Limited 16
Smart-Turner Machine Co. 69
Standard Bolt and Screw Co 74
Standard Tool Co. 78
Starrett, L. S., Co. 77
St. Clair Bros. 66
Stevens Co. of Galt. 59
St. Lawrence Supply Co 68
Sturtevant, B. F., Co. 16
Spon & Chamberlain. 58
Sylvester Mfg. Co. 71

T

Taylor & McKenzie 76
Technical Pub. Co. 80
Toronto and Hamilton Electric Co 69
Toronto Engraving Co. 8
Toronto Plate Glass Importing Co. 66

U

Underwood, H. B., & Co. 7
Union Drawn Steel Co. 14

V

Volta Electric Repair Works. 75

W

Warner & Swasey Co. 3
Waterous Engine Works Co. 12
Wayland Williams & Dadson 70
West Haven Mfg. Co. 76
Wells Pattern & Model Works. 66
Western Machine Co 70
Williams & Wilson 18
Whitman & Barnes 77

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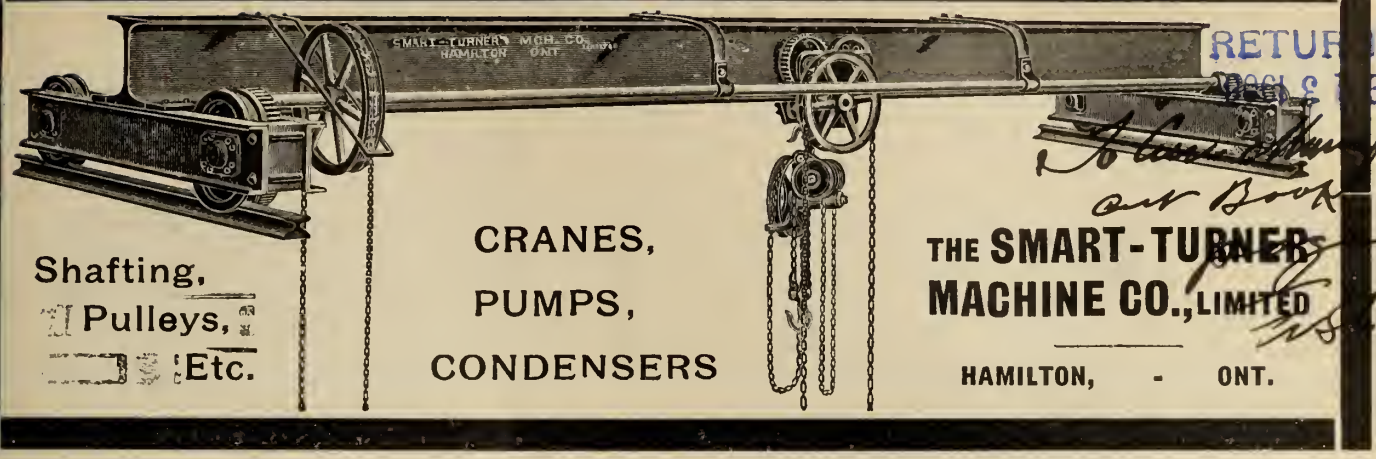

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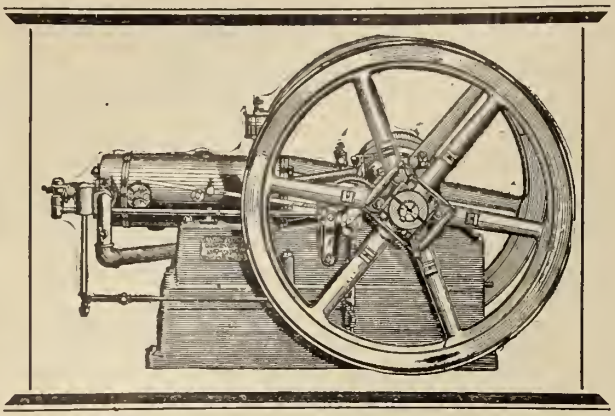

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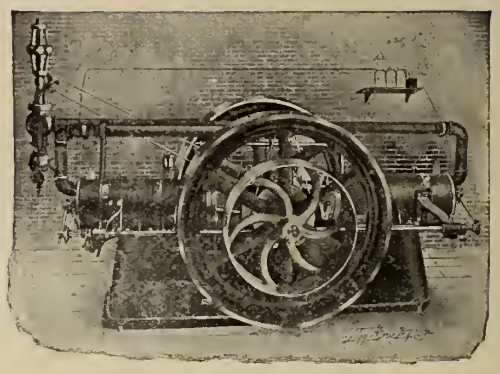

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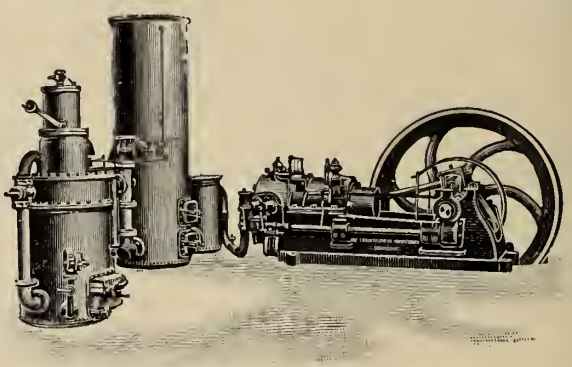

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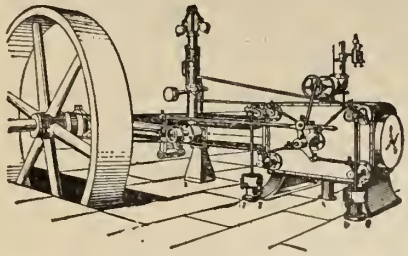

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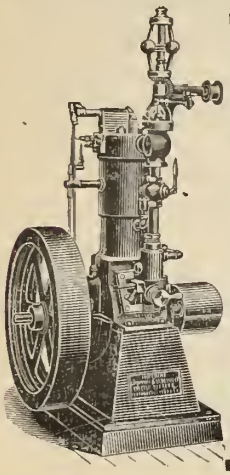

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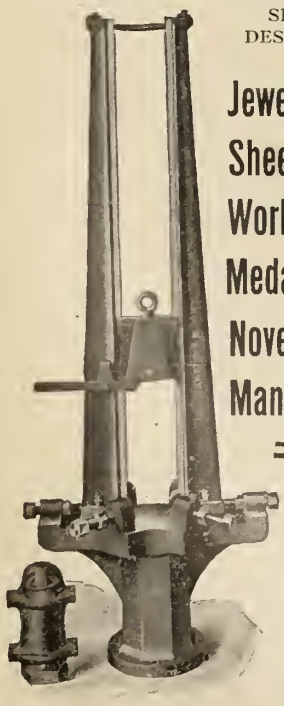

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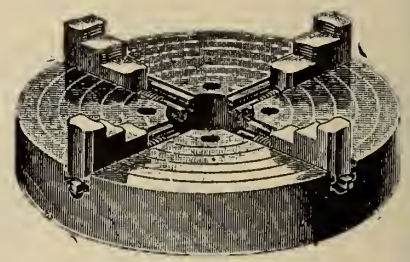

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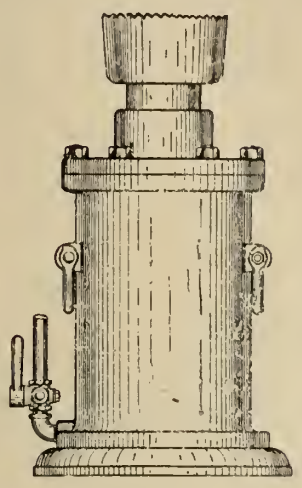

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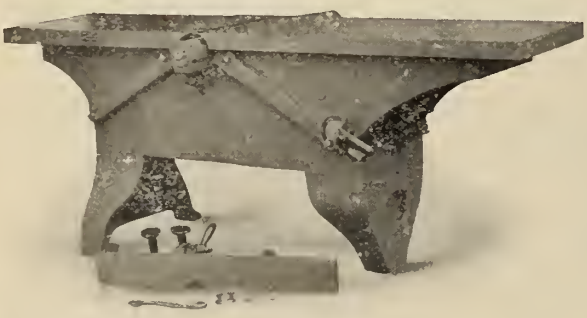

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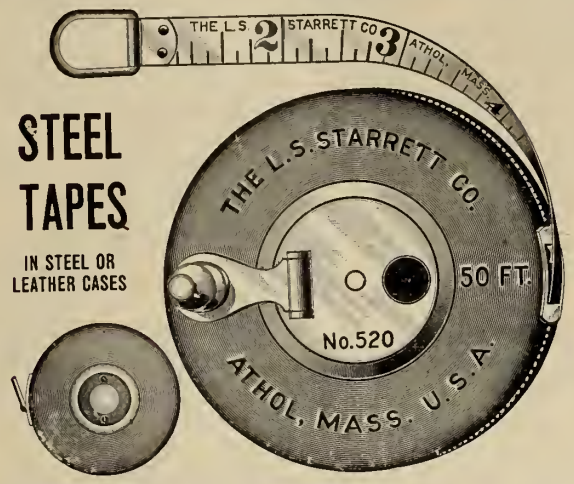

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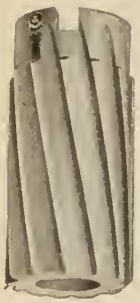

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Reamers, Taps and Dies Screw Plates

We have installed the necessary machinery for making all kinds of Reamers. The standard of quality will be kept as high as we have set for our **TAPS, DIES** and **SCREW PLATES.**

We are now HEADQUARTERS in Canada for **REAMERS**

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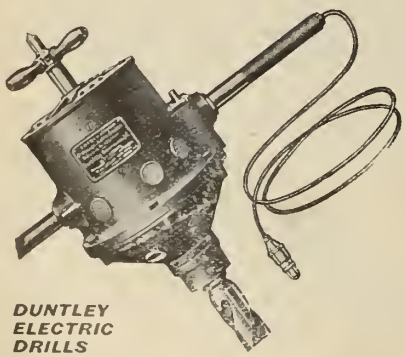

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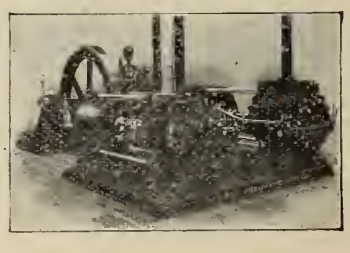

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We manufacture our Franklin Compressors in more than 100 styles and sizes.

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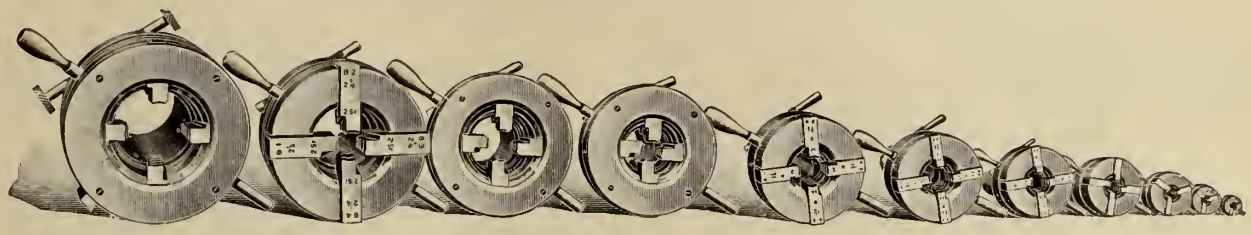

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Our Style "D" Die Head cuts right or left hand threads of any length—standard or special pitch. A micrometer adjustment assures the greatest accuracy and speed in changing the diameter of the threads. Dies are operated automatically by stopping the travel of the turret slide. Overcomes all the disadvantages of a solid die. Saves a lot of time when used on screw machines, turret lathes and the carriage of an engine lathe. If you want to reduce cost and increase output, send sample or blue print of your work—we will tell you size and price of the tool you need.

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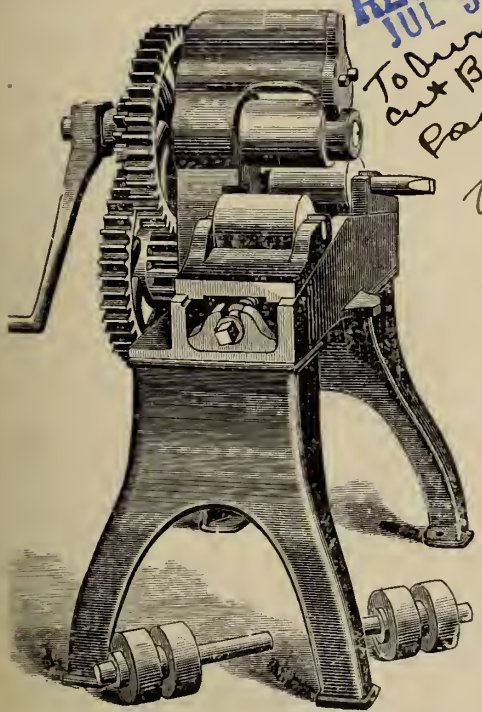

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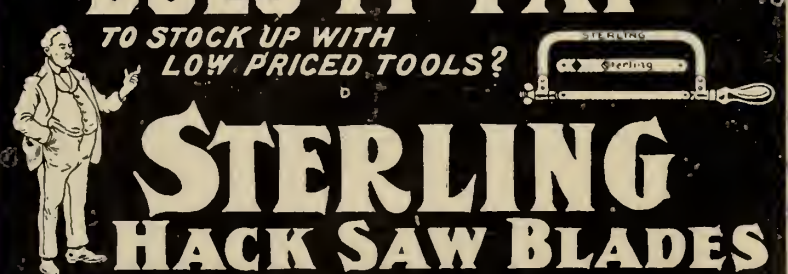

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ARE NOT THE LOWEST IN PRICE BUT THEY ARE

THE CHEAPEST { FOR YOU / FOR YOUR CUSTOMERS.

BECAUSE, MADE FROM THE HIGHEST GRADE OF STEEL THAT MONEY CAN BUY. MADE WIDE AND HEAVY.

There's a purpose in this. It costs us money.

COSTS YOU NO MORE THAN LIGHTER THINNER BLADES.

DIAMOND SAW & STAMPING WORKS,
BUFFALO, N.Y. U.S.A.

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THE FINEST AND BEST LATHE TOOLS ON THE MARKET

Offset Tool Holders ***Inside Tool Holders***

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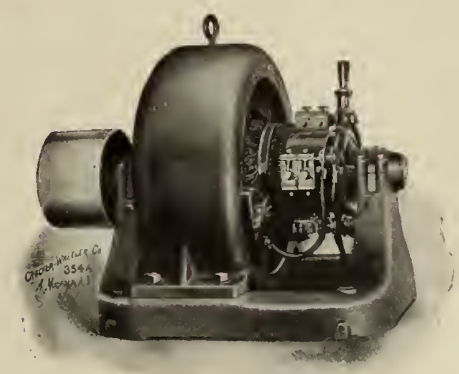

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ALL SIZES

FOR DIRECT CONNECTION OR BELT DRIVE

Form L. Machine outputs 1-4 to 3 H.P.

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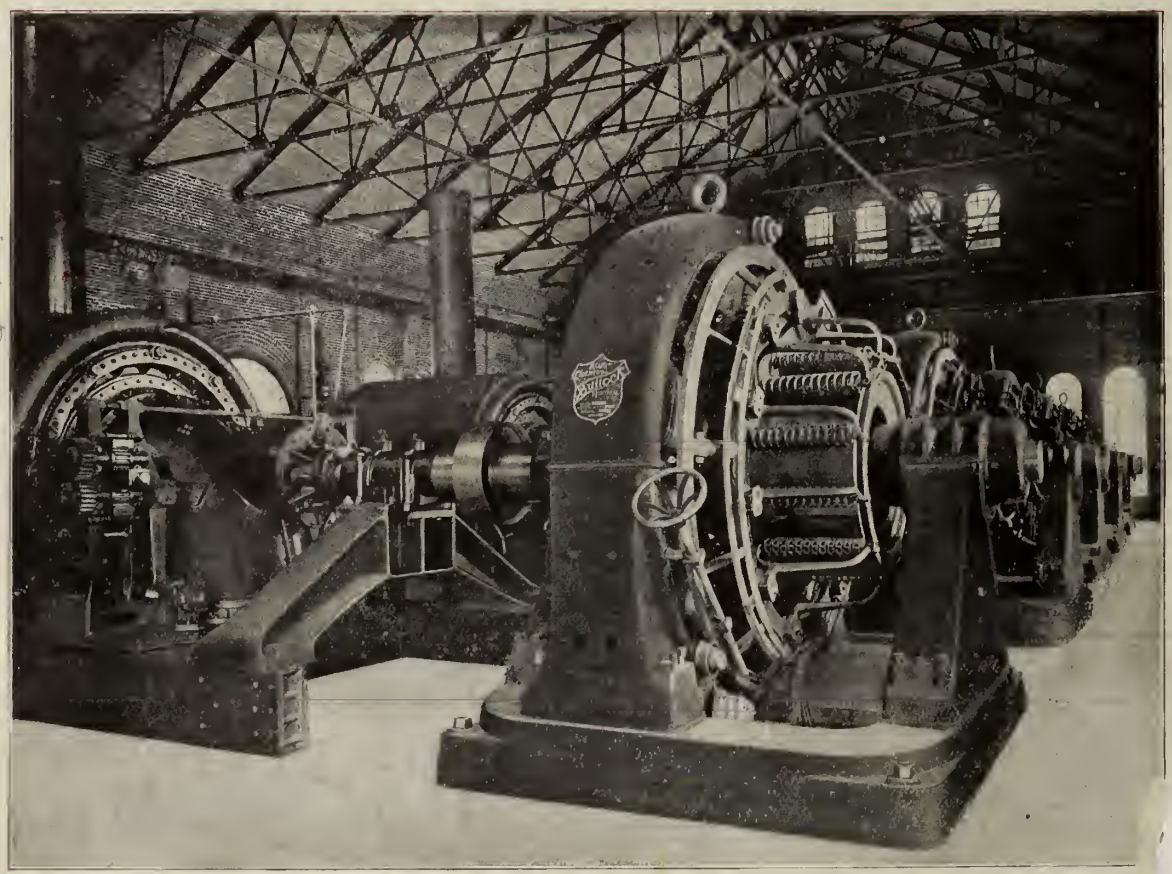

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This is a view of the power house of the Northern Aluminum Co., Limite Shawinigan Falls, Que., showing our 940 K. W. interpolar generators, the largest of the kind in operation, and the first built in Canada.

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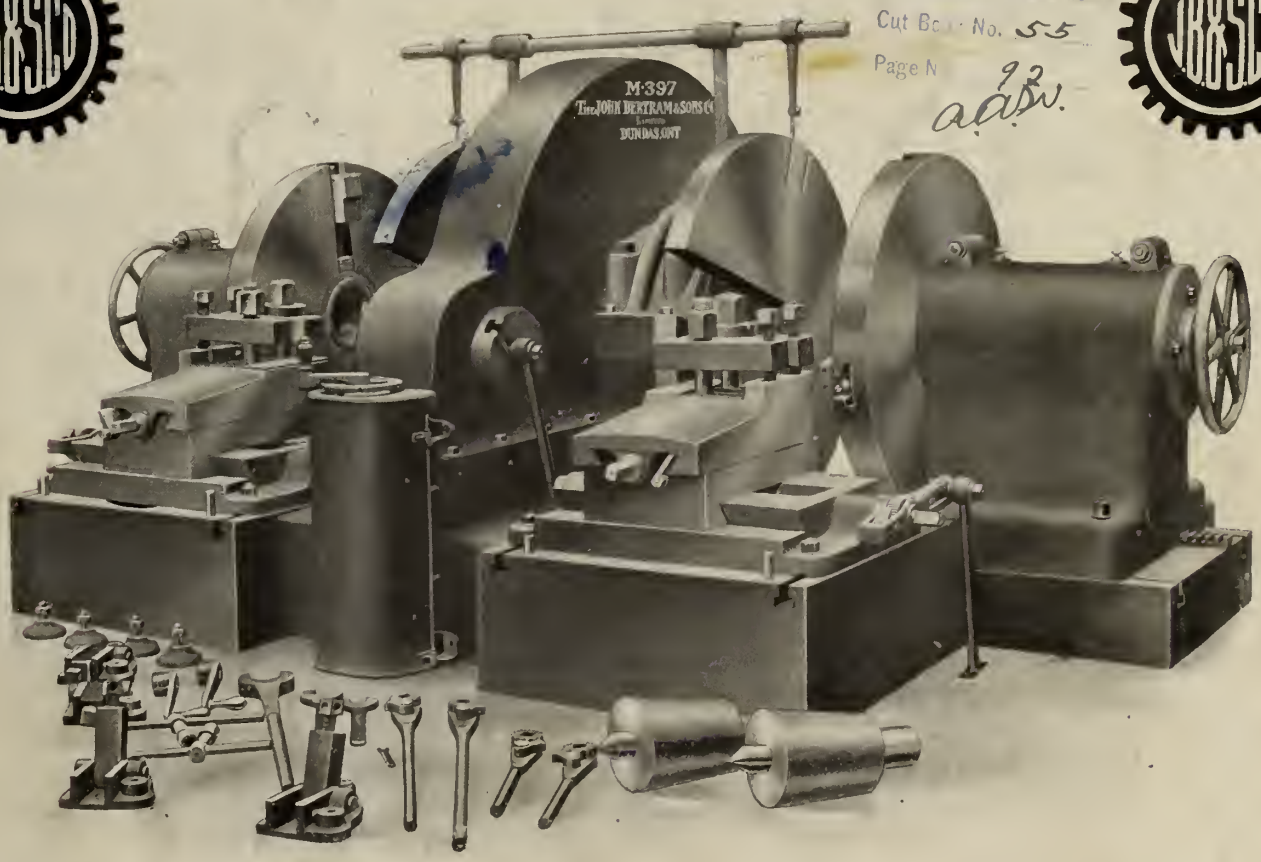

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We manufacture each and every machine we advertise.
If interested, write for description and list of users.

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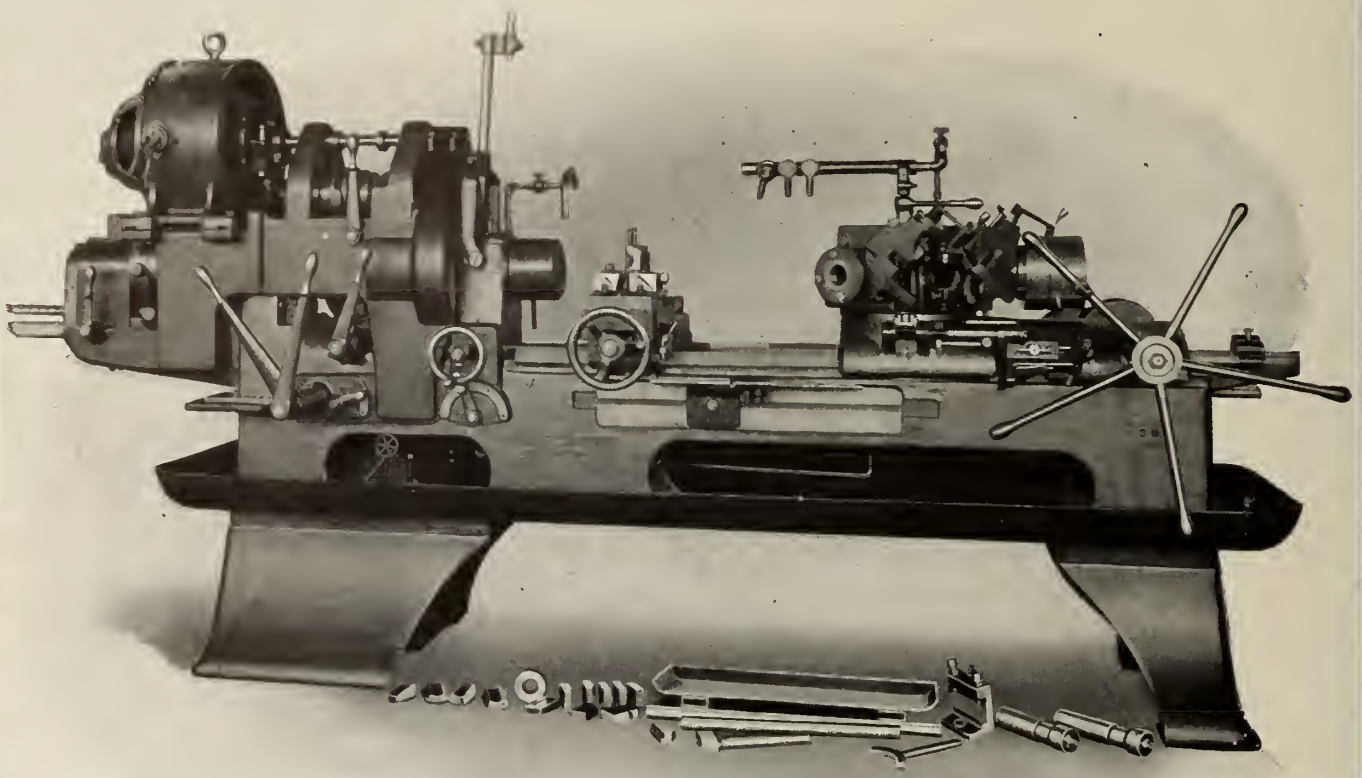
TURRET LATHES

FIVE SIZES, $\frac{5}{8}$ x 4½-inch, 1 x 10-inch, 1½ x 18-inch, 2 x 26-inch, 3 x 36-inch.



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The motor drives through a speed-box which, with the double friction back-gears, affords a wide range of speeds.

Cross and longitudinal power feeds are positive geared, reversible, and have automatic stops in either direction.

The cross slide permits the use of larger forming tools than can be held in a turret and makes possible the use of three turret tools at one time.

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Perfection in High Speed Engine Design. Noiseless Running — Perfect Lubrication — Accessibility — Economy

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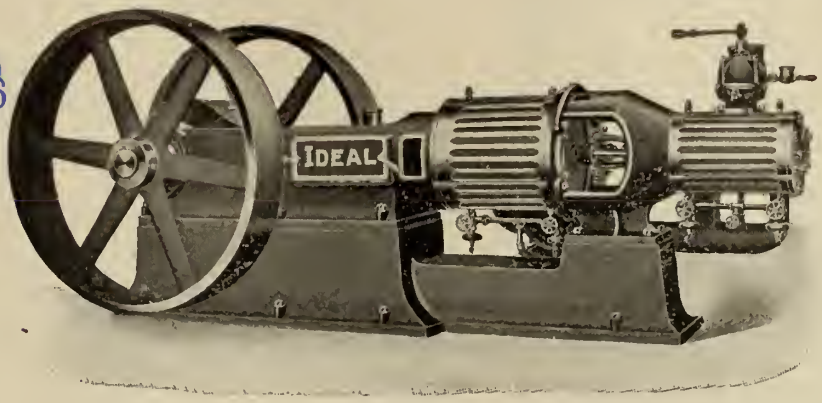

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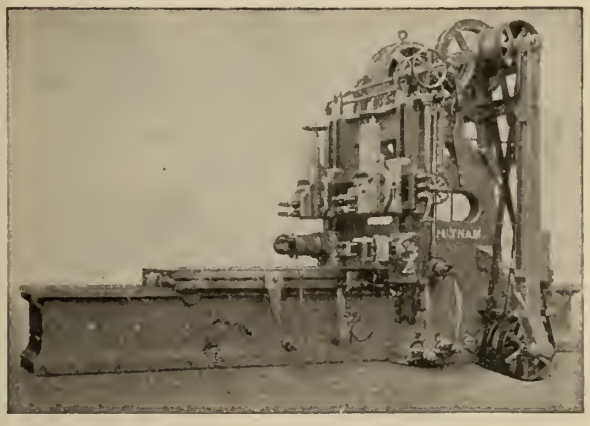
Always Investigate "Quality"

when considering the qualifications necessary in a motor for a given class of work.



Westinghouse Type S Motor Driving Putnam Planer.

The Westinghouse Motor Qualities

which tell in machine-tool drive are:

Rigid construction—Heavy shafts—Split and interchangeable bearings, with two oil rings in each—Bearings may be removed for replacement without disturbing pulley—Shunted brush-holders and perfect brush-holder adjustment—Water-and oil-proof field coils.

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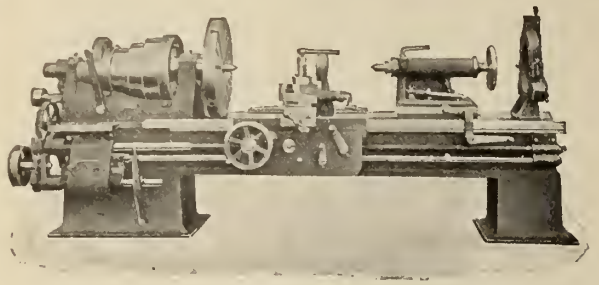
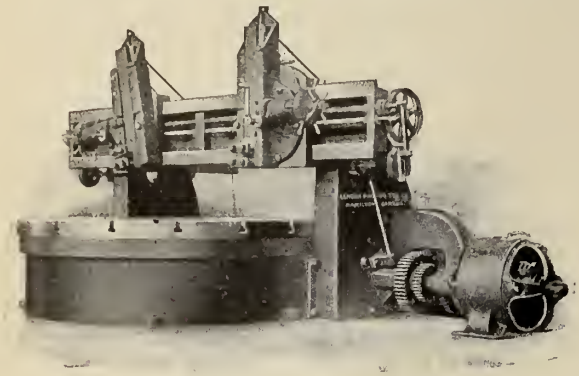
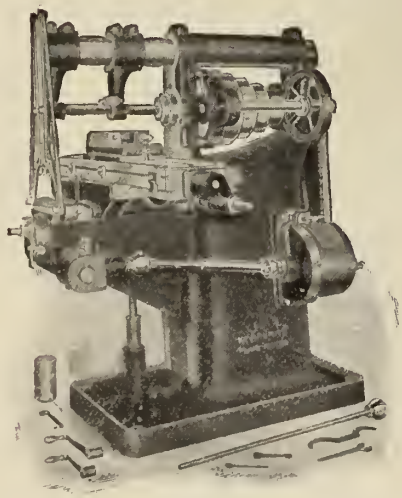


27-in. Double Back Geared Engine Lathe.



100-in. Tire Boring Mill.



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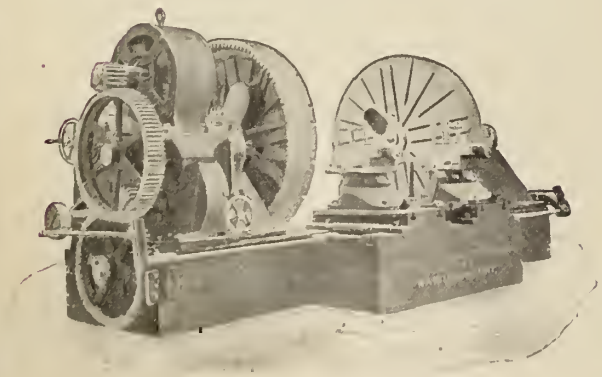

90-in. Driving Wheel Lathe.

HERE are illustrated several of our latest types of High Grade Machine Tools. In designing our different lines of machines every part is planned for the rapid production of accurate and reliable work. Machines are built exceptionally heavy and capable of using High Speed Steels to their maximum capacity. Our new plant at Hamilton is the most complete of its kind in Canada, and is equipped with every facility for the rapid handling of heavy and accurate work.

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London Machine Tool Co.

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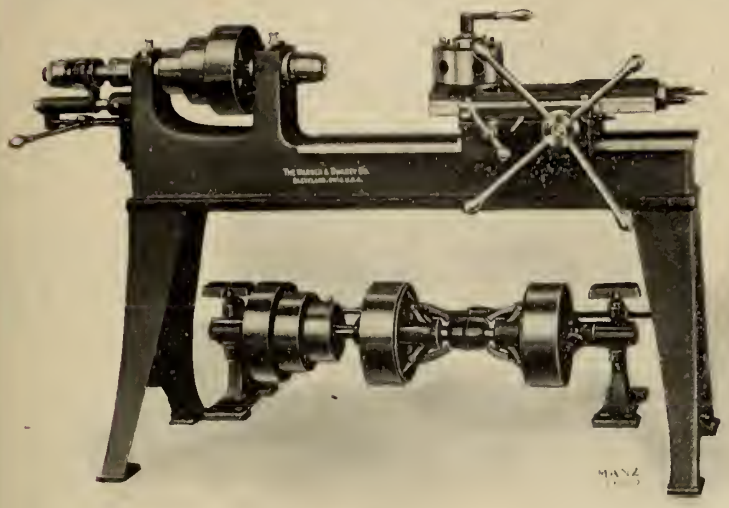
HAMILTON, - CANADA

IN OUR NEW DESIGN OF

SETOVER TURRET LATHE



16" PLAIN HEAD SETOVER TURRET LATHE WITH AUTOMATIC CHUCK.

the turret revolves automatically by the backward movement of the slide.

OTHER FEATURES

Rigid construction—head cast solid with bed.

Independent adjustable stops for each tool.

Positive centre stop for cross movement of slide.

Turnstile feed.

Graduated dial for setover screw.

Made in three sizes, with Plain or Geared Friction Head; with or without Automatic Chuck and cut-off.

The Warner & Swasey Company

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AUTOMATIC GANG DRILLS

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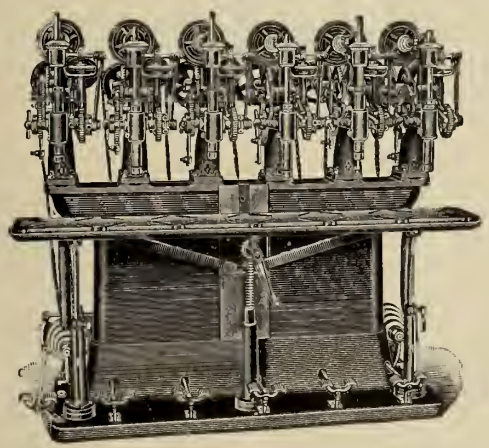

These machines have independent self-operating spindles. Built in two, three, four and six spindle styles, 14-inch, 20-inch and 23-inch swing.

They are the latest machines in shop practice for most rapid and economical output.

Complete catalogue ready for those interested.

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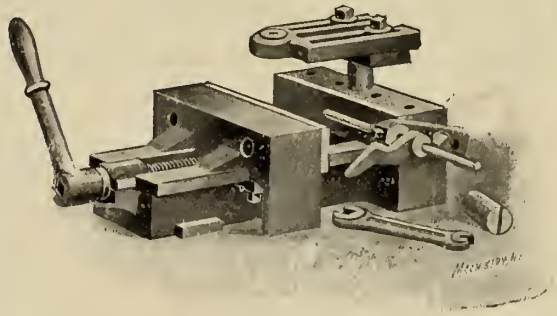
B. F. BARNES DRILL and LATHE BUILDERS COMPANY GANG DRILLS FOR RAPID WORK ROCKFORD ILL. U.S.A.

The advantages of a Radial Drill secured by using our



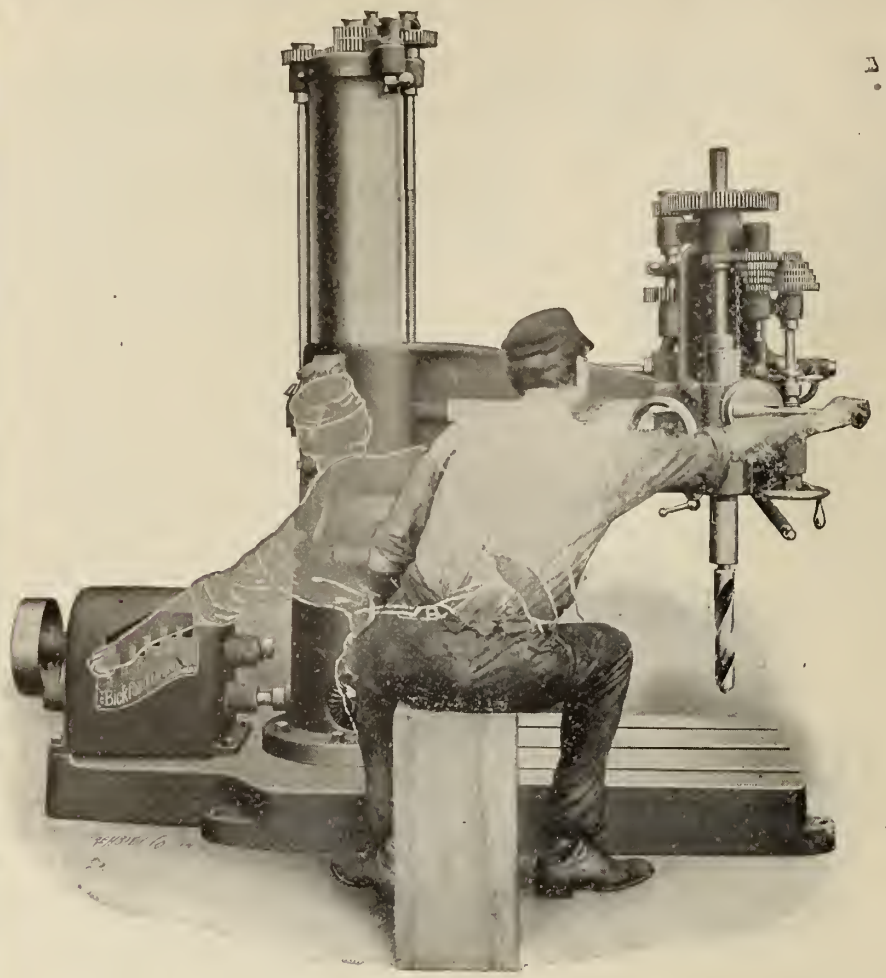
UNIVERSAL DRILL JIG VISE

Instead of swinging drill arm you slide our vise about on the table to get the required positions for drilling, no need to bolt vise to table. Get one and note these advantages.

THE STEVENS COMPANY OF GALT,

LIMITED

Galt, Ont., Canada.



The Lever You Want Right At Your Finger-Tips

Stop running "round" to the back of your machine for a lever that you use from 1 to 20 times a day.

Everything Within Easy Reach of the Operator

This is what we claim for this new 30″ **BICKFORD RADIAL**—in fact for all our Radials. And we can prove it, too, not by argument or glib assertion, but by actual demonstration. Look at the cut—did you ever see a handier, neater or more stockily built Radial in your life?

And it's just the thing for taking care of the ordinary work as found in the average shop—it was built for that purpose, you know.

Then, again, we want you to put in the little Radial in place of the large Upright you were thinking of buying. It doesn't cost much more, has infinitely greater productive capacity and will out-last and out-drill any Upright ever built.

It's made in three lengths of arms, remember, 30″, 36″, and 42″.

Circular 1-A. Shall we send it?

The Bickford Drill and Tool Co.

Cincinnati, Ohio, U.S.A.

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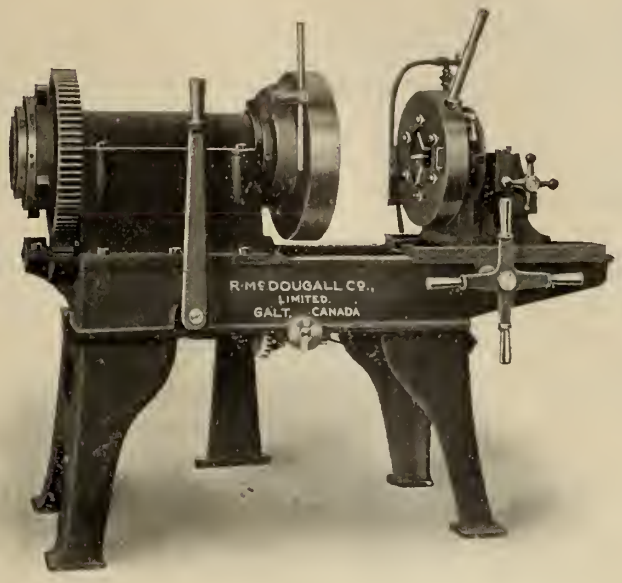

Pipe Screwing Machines

We will have a few of these tools ready for shipment Sept. 1st. They are built like a machine tool and give the utmost satisfaction. We make sizes from ¼-in. to 6-in. and guarantee satisfaction in every case.

Will be pleased to furnish details on request.

WE ALSO MAKE

LATHES AND PLANERS

THE R. McDOUGALL CO., Limited

GALT, CANADA

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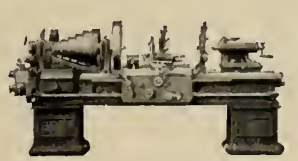
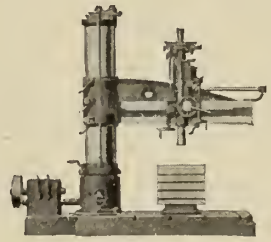
MODERN MACHINE TOOLS

WITH BELT OR MOTOR DRIVE

POWERFUL



14 in. to 62 in. Swing.
With "Quick Change Gear Mechanism."



2½ ft. to 7 ft. Arm.
Driven through Speed Box or Cone.

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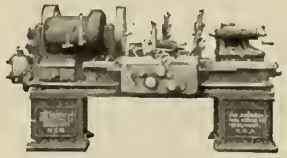

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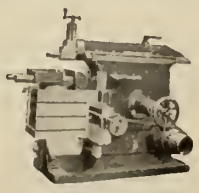

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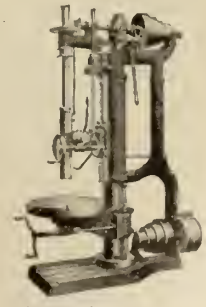

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WE HAVE A FEW OF THESE MACHINES READY FOR IMMEDIATE DELIVREY

This machine is distinctly a cutter grinder, and was designed to fill the want for a machine to sharpen milling cutters of all kinds and shapes, without special fixtures or special-shape emery wheels, being heavy enough to eliminate all vibration and still be easily operated. It weighs about 1370 lbs. The table, which has a long bearing on the saddle, has a longitudinal feed of 20 in., cross adjustment of 7 in., with a vertical adjustment of 6 in. Cutters 1 in. to 14 in. can be taken between centres. The table can be used at different angles with the spindle in horizontal plane, by swiveling the knee around the column. The machine is compact, durable, adaptable and a necessity for the busy shop.

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A Centralized Apparatus which is under one man's control;
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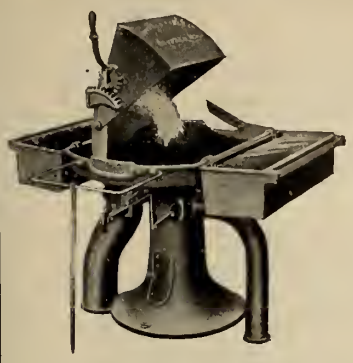

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Buffalo Stationary Forges, both with and without down draft attachments, are made in various styles suitable for every class of work, and form the subject of a special catalogue.

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Growing tools. These four tools shown herewith have been developed during the last decade until they represent the best values that exist in smith shop equipment. Thoroughly good in every detail, their use denotes the progressive craftsman.

Buffalo No. 625 Outdoor Forge.—Especially designed for rivet heating, tool dressing, etc.

Buffalo Punch, Shear and Bar Cutter

All combined in one tool. Frame is of Armour plate. Cast iron stand. Balance of machine is of drop forgings and crucible steel. Punches ½-in. hole in ⅜-in. plate. Shears plate of any width and up to No. 8 gauge. Bar cutter cuts off round bar from ¾-in. to 0-in. and flat bar 2½-in. x ⅜-in. Weight, 320 lbs.

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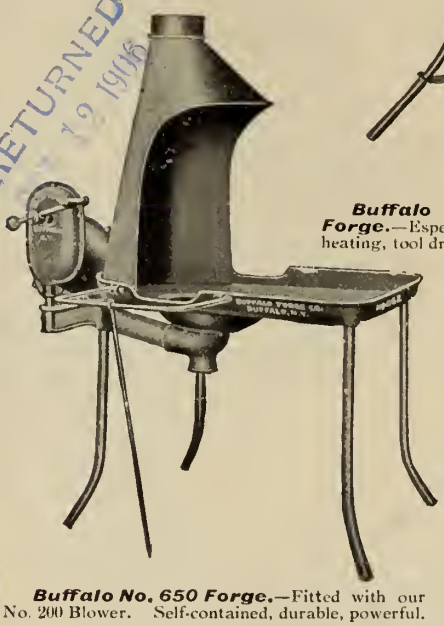

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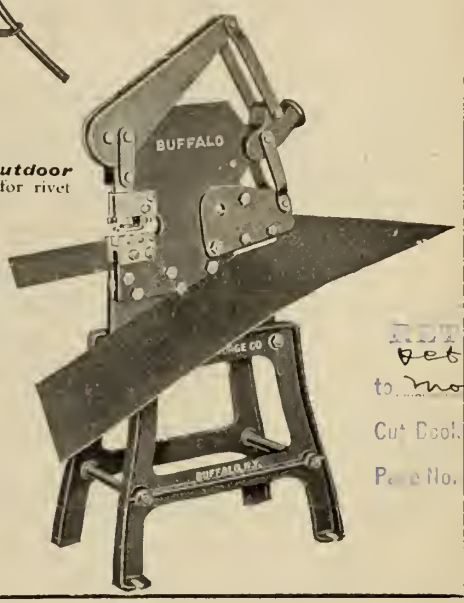

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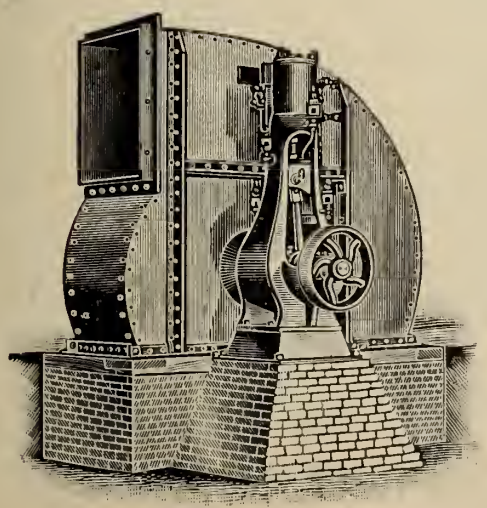

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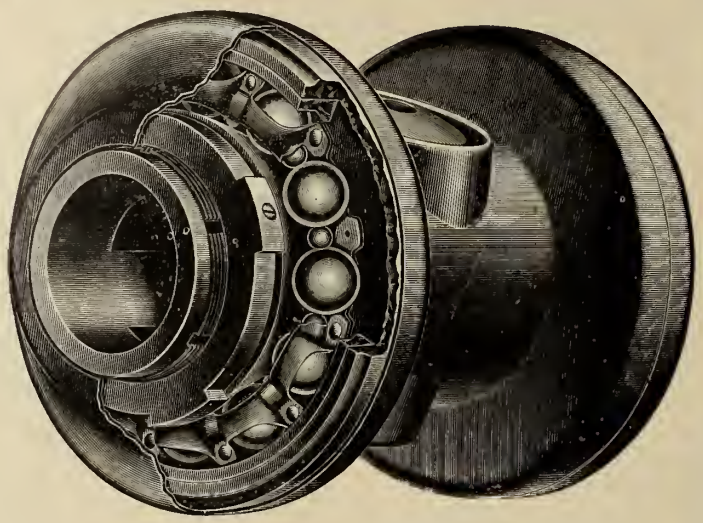

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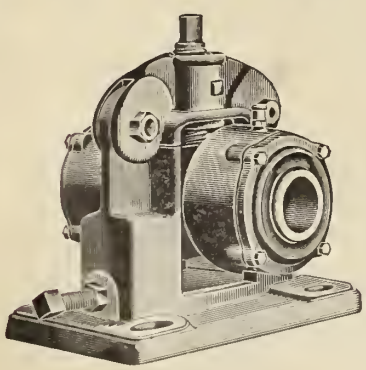

You can't make money unless you save money. You can't save money unless you make money. Isn't that so?

There will always be two manufacturing costs—labor plus material.

With that portion of labor which relates to your machinery equipment we wish to deal.

Your men may be skilful and careful and yet not be profitable to you, and why? Because perhaps only a portion of their skilfulness and carefulness goes into the material. The rest goes into the air. Its name is **waste**.

But give these same workmen an equipment where

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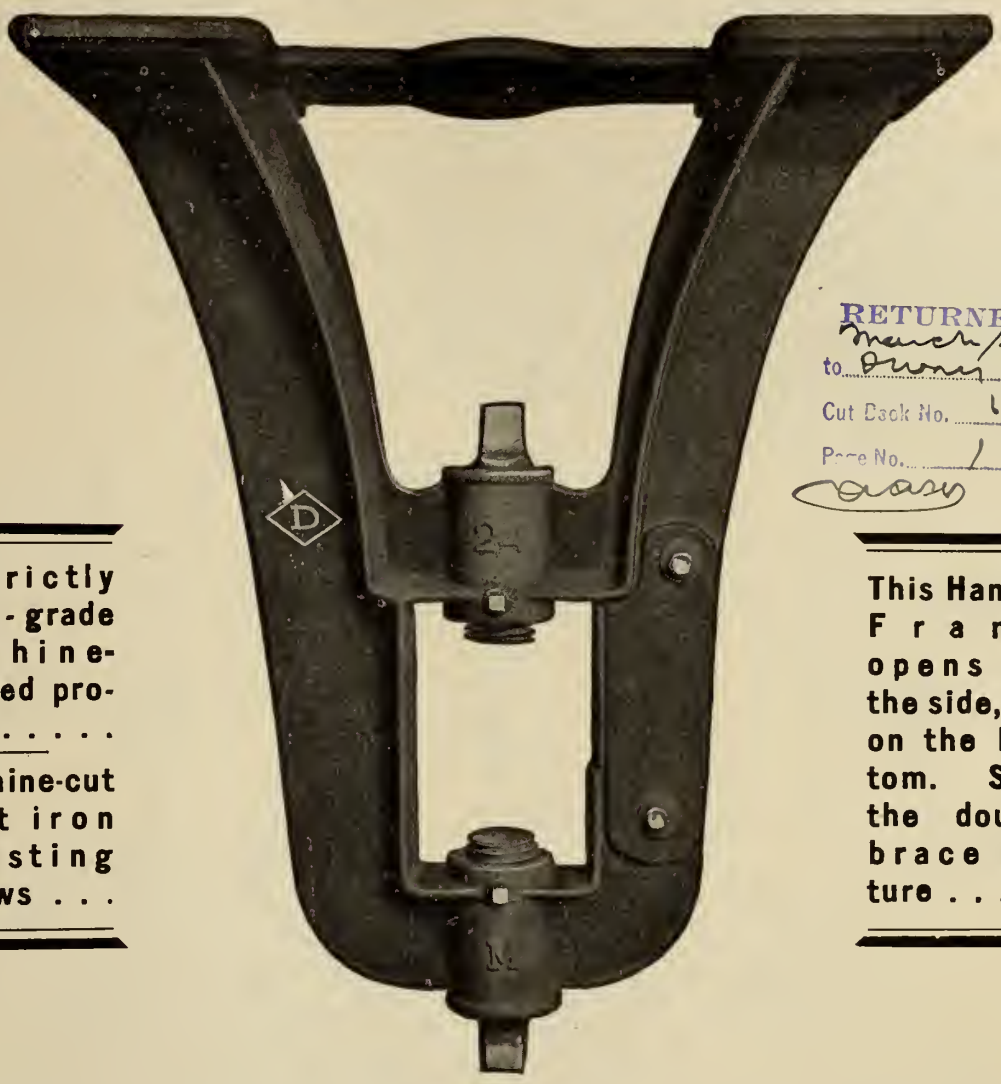

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Carried in stock in all sizes from 8-in. to 36-in. drop. Self-oiling or plain bearings.
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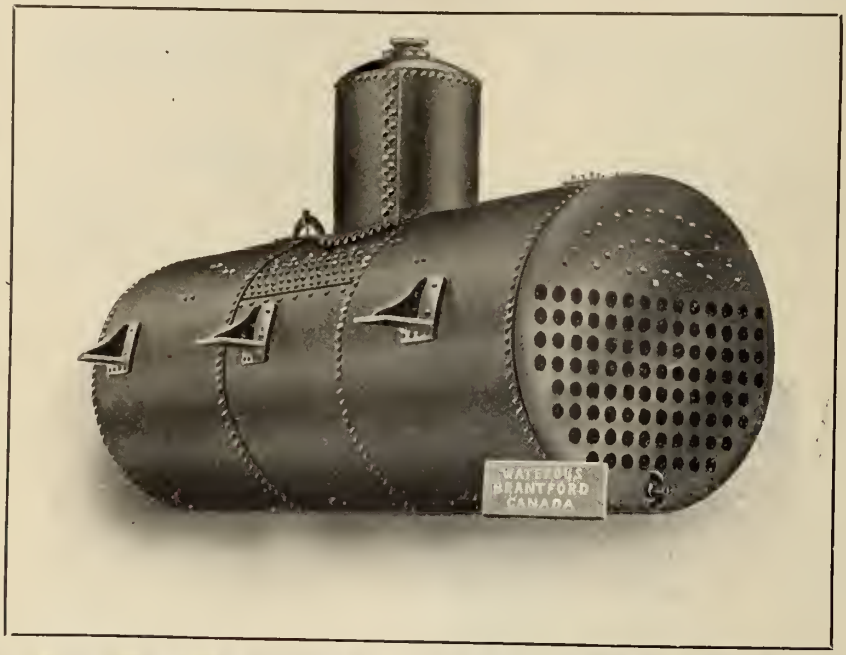
Brantford, Canada



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Saw Mill and Pulp Mill Machinery, Engines, Boilers, Fire Apparatus, Brick Machinery, Elevator and Conveyor Machinery, Chain, Belting, etc.

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We are specialists in the design of gearing arrangements. We can furnish immediate quotations and supply at short notice Machine Cut Spur and Worm Gearing up to 11 feet diamenter in Cast Iron, Steel or Bronze. Also Planed Bevel Gearing, theoretically and practically correct, up to 50 inches diameter, any pitch, in any metal. We can also give quick delivery on Machine Moulded Cast Iron and Steel Gearing up to 20 feet diameter.

CORRECT DESIGN. LOWEST PRICES. BEST MATERIAL.

W. B. McLEAN & CO.

Successors to McLEAN & SOPHUS

ENGINEERS AND MACHINERY MERCHANTS

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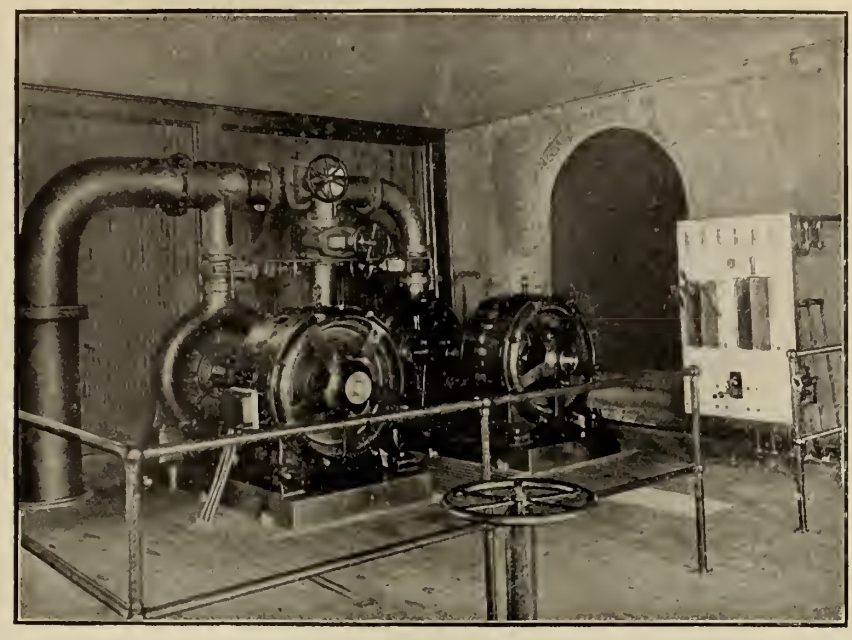

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The pumps are of the improved Worthington Turbine type, and are 8" in diameter, working against a pressure of 160 lbs.

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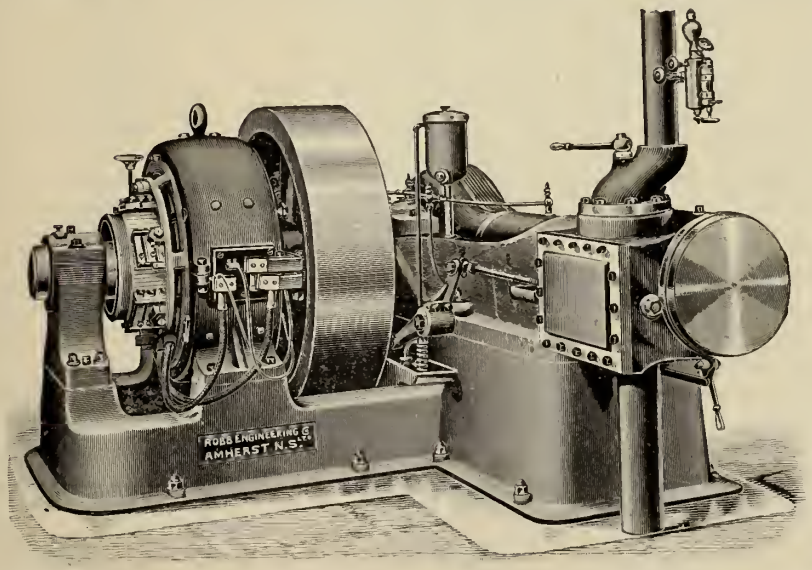
Not One Cent for Repairs!



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"After eighteen months of hard service, the 'Robb' engines are in excellent shape, running very smooth and without a bit of vibration. Up to this time they have not cost one cent for repairs, the only expense being for steam, oil and packing, and this lower than the average. Perfect alignment, parts well machined and good design, make the 'Robb' the most economical and labor-saving engine that has ever come to my notice."

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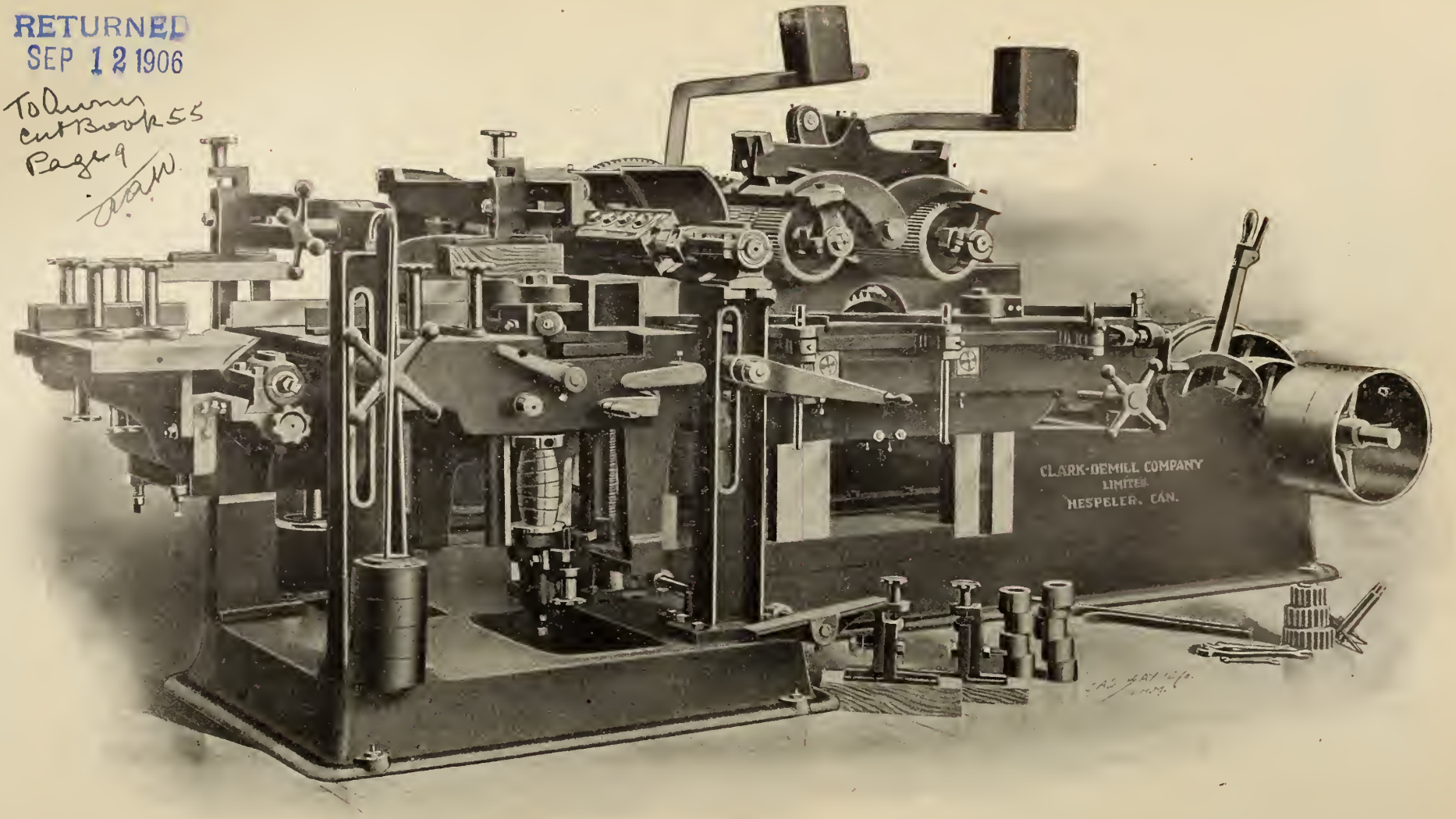

Extra Heavy Moulder, on Base—Planes 10 inches, 12 inches and 13 inches wide, by 12 inches thick. Has eight changes of feed, 11, 15, 19, 22, 25, 34, 42 and 50 running feet per minute. Speeds of feed can be arranged to suit purchaser. Write us for circular describing this machine fully, and also for prices and description of our full line of wood-working machinery.

CLARK-DEMILL CO., LIMITED

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Few people have any idea of the size and extent of this business and the wide range of machinery we carry in stock.

Our display in **The Cyclorama Building,** adjoining the Union Passenger Station, is the biggest of its kind in America, and anyone at all interested will find a liberal education here in all kinds of **Machine Tools, Wood-working Machinery, Power Equipment and Steam Appliances,** together with a complete stock of **Engineers' and Millmen's Supplies.**

We frequently give exhibits of machines in operation, and would especially call the attention of visitors to the Canadian National Exhibition to our complete exhibit of **Modern Machinery,** ALL IN OPERATION IN THE MACHINERY HALL ON THE GROUNDS.

The Imperial
Gas and Gasoline Engines

The only Engines built with a range of speed from 100 to 600 revolutions per minute, changed while the Engine is in motion

Style E, 3 H.P.—Height 3' 9", weight 550 lbs., base 13" x 23".
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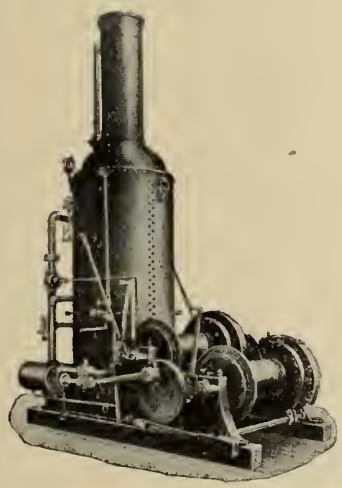
These can always be seen here in operation.



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The standard sizes have 6½-in. x 8-in. and 7-in. x 12-in. cylinders. Supplied with or without Boilers, at prices that won't interfere with your buying.

If you want to save money on machinery, send for our prices. Mail orders filled promptly. See that you receive our SPECIAL EXHIBITION NUMBER MONTHLY STOCK LIST.

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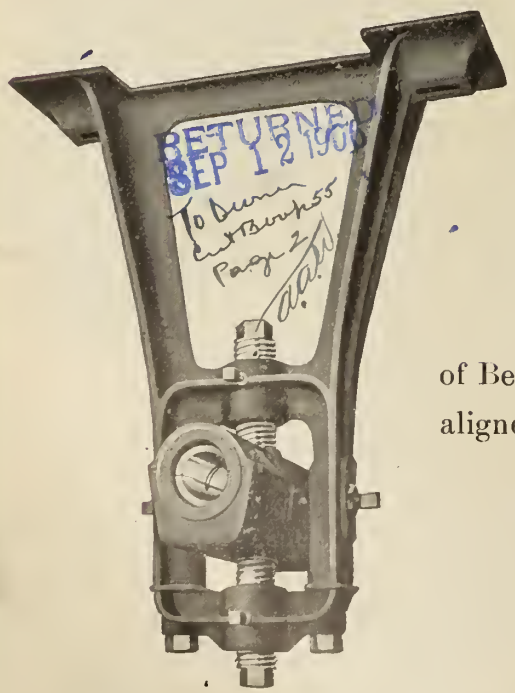
We carry a well assorted stock of Machine Tools, of these different manufacturers in stock and our shipping facilities are enhanced by our being able to draw on our Branch Houses

YOU CAN SAVE 20%



of your shaft friction or 5% of your horse power by keeping your shafting in accurate alignment.

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Ball and Socket, Ring Oiling, Drop, Post and Bracket Hangers and Pillow Blocks, are the only Shaft Hangers with heavy Plungers at top and bottom of Bearings, that also have a horizontal adjustment. Shafting aligned in ¼ the time it takes with other hangers.

SPECIFY "UNIVERSAL GIANT" WHEN ORDERING

THE CANADIAN FAIRBANKS CO. Ltd.

MONTREAL TORONTO WINNIPEG VANCOUVER

Machinery at the Fair

Canada's National Exhibition at Toronto Shows New Features

WITH the opening of the great exhibition at Toronto this year under the most favorable weather conditions possible it was evident that this, the greatest exhibition of Canada, was to have the greatest year in its history. The most notable new feature in connection with this year's undertakings is the splendid new Process Building, which surpasses any building that was ever built for any exhibition. It is of brick and steel with metal roof, and makes a big addition to the exhibiting capacity of the fair. It has afforded manufacturers an opportunity of showing the interested public how different lines of goods are manufactured. Here may be seen such processes as making shredded wheat, baking bread, buns, cake, etc., making candy, mixing dough, printing, weaving carpet, glass cutting and machine tool operating, as well as the production of producer gas and the operation of gas engines therefrom.

This last feature is the most striking connected with the mechanical part of the whole exhibition. For the first time in the history of the fair these have been shown and in working order. In the Process Building one producer plant is running a dynamo supplying a large number of display lights, while another drives a shafting, with small coal consumption, for one side of an entire wing. These have naturally come in for a good deal of attention and created no small interest, being the first opportunity the large majority of people have had of seeing them in operation. In conjunction with producer plants the surprisingly large number of gas and gasoline engines shown are somewhat of a criterion to the importance of these prime movers in industrial pursuits. At every turn the visitor is confronted with an exhibit of gasoline engines of various sizes and makes; many of them are in operation and come in for perhaps more attention than any other feature of the exhibition.

The building of the new Process Building has shown more clearly than ever the inadequate quarters supplied by the management for machinery exhibits. In the machine tool line but three firms had machines and of these only one was Canadian. The exhibitors have complained that it is almost impossible to handle machinery in the present building. A year ago it was rumored that a new Machinery Building was under consideration. It is hoped for the sake of the present machinery exhibitors and probable future ones and for the standing of the exhibition as well that the matter will be taken up and before another year a building commensurate with the importance of the machinery trade erected.

Reliance Gasoline ngines.

Owing to the short time since the Labatt Manufacturing Co., of London, took up the manufacture of the celebrated Reliance engines, their exhibit in the north wing of the Process Building is less extensive than would otherwise have been the case. This engine is well known throughout the United States and celebrated for the various desirable features. In this exhibit are shown running two vertical stationary engines, one of them being 3 h.p. and the other 5 h.p. Mr. Frost, who has had many years' experience in machinery lines in the United States, is looking after the exhibit. At the London exhibition during the week commencing September 7 the Labatt Manufacturing Co. expect to have a number of their engines, both stationary and portable, in operation, and will show their output on a much more extensive scale than was possible at the present time.

Canadian National Exhibition—Mechanical Figure at Main Entrance of Manufacturers' Building.

Machine Tools.

Among the most interesting of all exhibits in the Process Building is the operation of two machine tools by experts. These are shown in the exhibit of the Canada Cycle & Motor Co., being a Gisholt lathe manufactured by the Gisholt Machine Co., Madison, Wis., and a Landis grinder made by the Landis Tool Co., Waynesboro, Pa. Mr. Chas. Spalding is representing the Gisholt Co. and the interests of the Landis Tool Co. are looked after by Mr. T. H. King. Every day the experts on these machines demonstrate to the curious public the marvels of the modern machine tool as regards accuracy of work and speed.

The Gisholt lathe is one of the latest patterns and can be used to great advantage in almost any kind of lathe work. Its accuracy and rapid work are two of its strong features. Its operation at the exhibition consisted of cutting out piston rings, four at a time to a limit of variation within four one-thousandths of an inch. The grinder operated on the drop forge nickel shaft from the rough casting, being a No. 4 machine, particularly for that purpose. This is the most modern type of Landis grinder, so sensitive that a practically perfect measurement can be obtained. The crank shaft of the engine receives the shock of every forward impulse and has to transmit it to the driving shaft Its strength must be beyond question and as it has seven bearing surfaces its perfect machining is an absolute necessity. This machine gives every bearing surface a high polish and a surface accuracy to the one-thousandth part of an inch. It is the intention of the Canada Cycle & Motor Company to grind all pistons and cylindrical parts with this machine.

H. W. Petrie's Machinery Exhibit.

A valuable addition to the exhibits in the Machinery Hall is that of H. W. Petrie, Toronto. The display is without doubt a very handsome one from an artistic standpoint, and also a very appropriate one from a purely business standpoint. Neither expense nor trouble have been spared in making it a decidedly attractive exhibit, and those responsi-

ble for it have been amply repaid by the many expressions of appreciation which the exhibit has called forth.

The exhibit is quite representative, including as it does iron and wood-working machinery, grinders, threading machines, steam, gas and hot air engines. The two most striking features of the exhibit are the Lodge & Shipley improved patent head lathe and the fore and aft compound condensing marine engine, 6x12x9. This lathe is built for use with high speed steel, and tests are being made during the exhibition to determine what the lathe will do in the way of speed and feed when cutting different metals with high speed cutting tools. The marine engine is also undergoing a test in that it is continually running.

Wood-working machinery is represented by a Petrie west side band saw, suitable for furniture, novelty and like factories. Besides the lathe, iron working machinery is represented by a McDougall pipe cutting and threading machine, by a Petrie pedestal grinding machine, which is used to grind the tools for use on the lathe, and by a Phoenix centreing machine. Power machinery is, however, the best represented. In addition to the marine engine before mentioned there is a No. 1 Jewel automatic engine, 8 h.p., operating the band saw, which engine is made in sizes up to 75 h.p., and there is also a Petrie vertical steam boiler, a gas engine and a Rider-Ericsson hot air engine and pump, operating continuously. The gas engine is certainly worthy of special attention. The engine ex-

Canadian National Exhibition—Exhibit of the Economical Mfg. & Supply Co., Ltd., Toronto.

ETURNED
FP 4 - 1906
Canadian Manufacturer
Book 54
Page 95

Canadian National Exhibition—View of H. W. Petrie's Exhibit.

hausts into a muffler standing on the floor and from thence the exhaust comes right into the building, the puffs from which can be felt by placing the hand over the exhaust port, but which can be neither seen, smelt nor heard. This, of course, is a proof of the perfect combustion in the engine. Another important feature about the engine, besides the perfect combustion and noiseless operation, is the wide range of speeds which can be obtained, from 100 to 600 revolutions per minute, change of speed being made when the engine is in motion. This engine is known as the Imperial.

While special attention has been devoted to large machinery, small tools and supplies have not been forgotten, and in a show case has been made a handsome display of small tools and supplies of all kinds for engineers, machinists and mill men.

All considered the exhibit is a very creditable one to H. W. Petrie, and while exhibition visitors are being shown the different points of interest about the exhibit, they cannot fail to notice the courteous treatment received by all comers from those in charge of the exhibit.

Economical Mfg. & Supply Co.

A new exhibitor in the Machinery Hall this year is the Economical Mfg. & Supply Co., Limited, Toronto, who are

exhibiting the line of goods they themselves manufacture and also some of the products of the New York Belting & Packing Co., whose Canadian agents they are. From the accompanying illustration the style of the exhibit may be seen. The exhibit consists for the most part of a display of their boiler compound, belt dressing, graphite paint, graphite grease, lubricating graphite, graphite stove polish, etc. The foundation of these preparations is "Canada Graphite." This graphite is the amorphous graphite in which form graphite is very adhesive and for that reason makes an excellent lubricating factor in that it fills up all the little crevices and makes a very smooth surface. As a paint this graphite forms an excellent preserver of wood, iron and steel.

The safety hollow set screw is an important feature of the exhibit and undoubtedly users of set screws would be interested in seeing the many good points of this one. It is only very recently that the company have started to turn out these screws because of the difficulty experienced in getting a machine to "draw" the hollow from the steel blanks, but after this considerable attention will be given them.

The product of the New York Belting Co. exhibited consists of packing of different kinds very neatly displayed, but the Economical Mfg. & Supply Co. handle all their goods, including packing, pump valves, hose, belting and rubber goods of different kinds.

A sample of the lubricating graphite may be obtained at the exhibit, which might well be used to test the claims made for it as a lubricant.

Suction Producer Gas Plant.

The rapidly increasing interest in producer gas as a form of power, which has been evidenced during the past year, is remarkable, and in view of this it is only natural that manufacturers of producer gas plants should go to considerable trouble and expense to bring the merits of producer gas to the attention of the public at the exhibition. An exhibit like that of the Economic Power, Light & Heat Supply Co., 40 York street, Toronto, has not been before seen at the exhibition. A 40 h.p. Pintsch suction gas producer supplies gas for a 20 h.p. National gas engine, and to the gas engine is belted an electric generator, which supplies power for the lighting of several of the exhibits throughout the Process Building, in which building the Economic exhibit is situated. The economy of these suction producer gas plants has been the talk of power users for some time, and the Economic Power, Light & Heat Supply Co. are going to take advantage of this opportunity of demonstrating what the Pintsch producer will do along that line, that is if they can get sufficient load to run the engine economically.

This company are preparing to manufacture the Pintsch producer and the National gas engine in Canada, the gas plants and the engines which they now have in stock having been brought over from Germany and England respectively.

These producer plants are built in sizes from 4 to 2,000 h.p., it being possible for more than one engine to be supplied from the one producer by means of the Pintsch automatic governor, which prevents the suction force through the producer from varying, without reference to the number of engines which are running. The operating abilities of the National gas engine working on producer gas may be judged by the results of a test made at Derby by the Royal Agricultural Society of Great Britain a short time ago. The various English builders were invited to compete at this test, the prizes being a gold medal for the best engine and a silver medal for the second best engine, the awards to be made on the basis of the following considerations: Attendance required, the general design with respect to accessibility and compactness, regularity of working, fuel and water consumption, price, relative proportions of producer and engine, and the ratio of the volume swept by the piston to the brake horse-power. The results turned out well for the National gas engine and producer, they being awarded the gold medal. The coal consumption during these tests was remarkably low, being 0.84 lbs. per brake horse-power in the full load test, and 0.91 lbs. per brake horse-power in the

Canadian National Exhibition - Gas Plant and Engines of the Economic Power Light and Heat Supply Co., Ltd., Toronto.

RETURNED
SEP 4 - 1906
To Can Manufac
Cut Book Co
Pag 45

half load test, the duration of the test being 10 hours on a unit of 10 horse power.

Canadian National Exhibition Part of Fairbanks Co.'s Exhibit.

Canadian Fairbanks Exhibit.

The exhibit of the Canadian Fairbanks Co. in the Machinery Hall is as usual divided into two sections, one devoted to the products of the Fairbanks-Morse Canadian Manufacturing Co., that is, to gas, gasoline and oil engines, electrical dynamos and pumps of various kinds, and the other to the Fairbanks scales, valves and similar products. In addition there is the reception room, where weary exhibition sight-seers are welcome to rest, and where a platform scales is at the service of all comers. Those in charge of the exhibit are exceptionally courteous in explaining and demonstrating the various machines exhibited.

In the engine section are shown horizontal and vertical engines, both portable and stationary. A vertical electric lighting engine, governed by a throttling governor, runs a 6 h.p. Fairbanks-Morse dynamo, which supplies the power for the lighting of the exhibit and sign. There is also in operation a horizontal engine for general power purposes, where there is a varying load. This engine is provided with a hit-and-miss governor. The portable engine and the threshing engine have attracted considerable attention, they being the class of engines sold to the farming community, with which community the Fairbanks Co. do a very large business.

A prominent feature in the exhibit is the valve chair, a chair built up of standard Fairbanks valves. The particular feature of interest in these valves is the removable oscillating disk, which can be removed and replaced with very slight trouble. The valve seat is designed so as to prevent as far as possible the lodging of grit which would cut the seat or disk. The valve seat is made of a special composition of brass and phosphor-bronze, and the disk is made of phosphor-bronze. There are several other interesting features about this valve, and to those not acquainted with it, it would be well worth investigation.

The scales form an important and interesting department of the exhibit, there being displayed scales of all kinds and for all uses. These include trip and even balance scales, railway scales, flour and grain scales, postal scales and agate bearing scales. These agate bearing scales have attracted special attention because of their very fine adjustment.

The exhibit of wood split pulleys and iron split pulleys is also worthy of special attention because of the construction of the wood split pulleys. As well as being glued together the segments are riveted together, and this prevents the pulley from coming to pieces in factories where the atmosphere deteriorates the glue, as in canning factories, etc. There is also a special construction for bracing the rim from the hub of the pulley, which is not contained in any other wood split pulley.

Exhibit of Transmission Machinery.

Transmission machinery and devices of all kinds form the exhibit of the Dodge Mfg. Co., Toronto, the Dodge wood split pulleys, as usual, occupy a prominent position. Shafting and countershafting, tight and loose pulleys, bearings, friction and other clutches, shaft pedestals and hangers, a rope drive device, wood split pulleys and iron split pulleys, muff and flange couplings and all similar products are there exhibited, giving ample evidence of the character of the product of this firm.

Canadian National Exhibition.—Exhibit of Dodge Mfg. Co., Ltd., Toronto.

The exhibit of rope drive is very interesting, extending as it does from one side of the exhibit to the other, and showing the means of keeping a constant tension on the rope. The endless method

of rope drive is always recommended by this firm in preference to the individual endless rope for each groove in the pulley.

A special demonstration of the smooth-running qualities of the Dodge bearings is made by a drive of one countershaft by another by means of a small cord over the pulleys. On the same countershafting is given a practical demonstration of the operation of the Dodge friction clutch.

At present the plant of the Dodge Mfg. Co. is running day and night, so busy are they turning out their product, but there is a special demand for their wood split pulleys on the English market, and for that reason the department of the factory devoted to that product is exceptionally busy. So rapidly has the demand for their product increased of late that extensions of plant are now being considered.

Canadian National Exhibition—The Chapman Double Ball Bearing Exhibit.

Chapman Ball Bearings.

One of the attractions of the Machinery Hall is the exhibit of the Chapman Double Ball Bearing Co., of Toronto, where the merits of this desirable bearing in reducing friction are strikingly demonstrated. Perhaps the most notable feature of this exhibit is a mining car of the Dominion Coal Co. filled with anthracite coal, the gross weight of which is 5,500 lbs. The truck is fitted with Chapman bearings and mounted on tracks running along the side of the booth. The ease with which this heavy car glides back and forth on the track under a slight pressure of the hand is convincing proof of the efficacy of the bearings. In actual use it has been decided by mining companies in Canada that thus equipped, double the amount of coal or ore can be handled with the same labor than previously possible.

Along the centre of the exhibit are arranged about a dozen shaft hangers of different standard makes, showing the adaptability of the ball bearing to any of these. A pyramid of different sizes of wood loose pulleys mounted on a vertical shaft is another of the features of this interesting display and one which affords delight to the small boy, who never tires turning them and then watching to see how long they will run. He generally grows impatient long before they have ceased moving and speeds them up. The pulleys are not the only object in motion, for a carriage wheel and an automobile wheel are also mounted to show what a saving in the power and with what ease they turn. Besides a mule stand equipped similarly to the others are shown ball bearings for traveling cranes, marl cars, and thrust bearings.

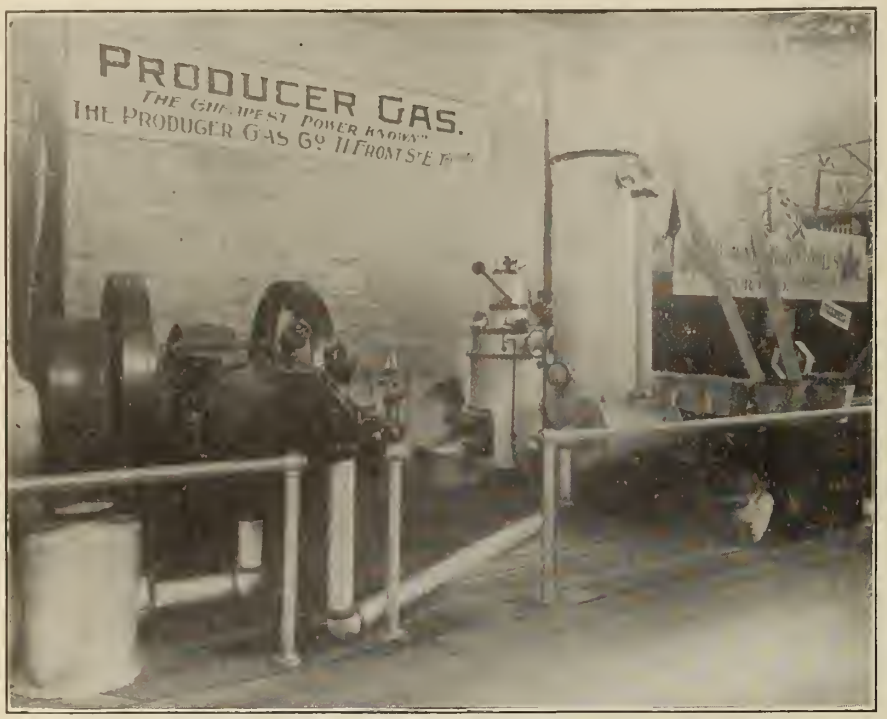
It is interesting to note that the entire shafting on both sides of the Machinery Hall is equipped with Chapman double ball bearings. By actual test it was shown that on adopting these a saving of 80 per cent. friction was effected. At the present time there are 400 factories in Canada using these bearings.

The exhibit was in charge of Mr. C. M. Murray, who was kept busy answering questions by people interested in these power-saving devices and explaining in his courteous manner the many and varied applications for ball bearings.

A New Rotary Engine.

A new exhibitor in the Machinery Hall is the Manson Mfg. Co., Thorold, Ont. This company has but recently been organized and is now making application for an Ontario charter. The object of the company is to promote and manufacture a modification of the "Tree" rotary engine, which engine was recently being placed on the market by

the Imperial Engine Co. The Manson Mfg. Co. have taken over the Thorold Foundry & Machine Co. The engine on exhibit is a 35 h.p. one, running a



Canadian National Exhibition—The Producer Gas Co., Toronto.

30 k.w. dynamo, which supplies the power for the lighting of the exhibit The chief points claimed for the engine are economy in steam consumption, in oil consumption, and in floor space. Besides building this engine as a steam engine the company are adapting it to the use of compressed air.

Gas Engine Runs Shafting.

The Producer Gas Company, of 11 Front street west, Toronto, had a very interesting exhibit on the north side of the south bay of the new Process Building. The exhibit consisted of a 35 b.h.p. Campbell gas engine (factory type) and a 35 h p. Campbell suction gas plant. Visitors were at once impressed with the solidity and strength of all the working parts of the engine and the great simplicity of the gas producing plant. The engine, although considerably the largest gas engine in operation at the exhibition, was simply bolted to the floor without any special foundation whatever and in spite of this somewhat severe handicap, ran quietly and with little vibration. Another feature of the engine is that the valves are not seated into the main castings but into special valve plugs. These plugs engage metal to metal with the liner casting and can be detached for examination or cleaning in less than one minute. The combustion chamber, too, is so shaped that the proportion of heat lost through walls by radiation is reduced to a minimum. The cylinder also is fitted with liner, which can be removed in a few minutes should it ever be necessary to rebore. Ignition is effected by high tension magnate machine, which renders batteries and spark coils unnecessary, both the speed of the engine and the timing of the explosion are under the control of the operator whilst the engine is running. The Campbell Co. also make a feature of supporting the cylinder for the full length of the stroke by prolonging the massive bed plate. This effectually prevents the working loose of the engine on its foundation, a fault frequent with engines having long overhanging cylinders. The greatest interest, however, centred on the suction gas plant. The Campbell Gas Engine Co. claim to have achieved maximum efficiency with maximum simplicity—a very desirable result because a suction gas plant has a double advantage when its economy with labor and attention is as great as its economy with fuel. The gas plant consists of a simple form of gas generator, vaporizer, separator and filter. It is entirely automatic in its action and requires no attention beyond the necessary charging with fuel and as only 300 lbs. of coal are used in a day of ten hours on full load and considerably less than this if the load is lighter, the labor of coal handling is insignificant. The exhibit is in charge of Mr. G. P. Wallington, of the Producer Gas Co., Toronto, and Mr. T. G. Doyle, the Campbell Gas Engine Co's Canadian engineer. There are eight Campbell gas engines in operation in Canada and six producer plants, all giving excellent satisfaction. The total horsepower in operation or on order for Canada amounts to about 1,000 brake horsepower.

Canadian National Exhibition—Exhibit of Labatt Mfg. Co., London, Ont.

Many More Exhibits.

There are many more interesting exhibits at the Exhibition, mention of which will be made in a subsequent issue.

CANADIAN MACHINERY
and Manufacturing News

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NEW ADVERTISERS IN THIS ISSUE:

Barnes, T. W., Hamilton.
Canada Machinery Agency, Montreal.
De Clercy, Jules, Montreal.
Dods, P. D. & Co., Montreal.
Hart Mfg Co., Cleveland, Ohio.
Miller Bros. & Toms, Montreal.
Millen, John & Son, Montreal.
McLean, W. B. & Co., Montreal.
Moreau Barking Machine Co., Mitchell Station P Q.

THE CANADIAN NATIONAL EXHIBITION.

THE general prosperity of Canada at the present time is reflected in the Twenty-eighth National Exhibition held in Toronto, commencing August 27th. The growth of this exhibition has been in keeping with the growth of the country. This year further evidences of prosperity, expansion and development are evident. The new Process Building is a credit to the management of the Exhibition, and as a permanent structure for the purposes to which it is adapted it has probably never been surpassed. All lines of exhibits show a higher standard and an aim towards perfection that is laudable. That greater interest has been taken than heretofore is apparent from the greater number of manufacturers represented. Even with the enormously larger exhibiting capacity the space was at a premium, and in certain lines was not available.

The growing importance of the gas engine as a prime mover is the most striking feature in the manufacturing line. For the first time in the history of the Exhibition and, in fact, for the first time at any exhibition in Canada, gas producer plants running gas engines have been shown. Admitting this is proof of the slowness with which this country has taken up this phase of the prime mover question. The people of Great Britain and the Continent would probably smile to know that this is the case, but while they were busy developing the question of gas for power we were expanding along other lines, and are now ready to enjoy what benefit there may be by the researches made by them along this line. The three plants shown, two of which are in operation, give ample proof that they must be considered as a factor in the future. To most of the visitors they are a revelation, and those to whom they are not new are forced to admit that they must swing into a not unimportant place in the near future. Three years ago there was not a single gas producer plant in this country; now half a dozen firms are pushing these lines with vigor.

Another surprising feature to most people was the number of gasoline engines shown. Few people have been aware of the extent of development of this line in Canada during the last year or two. Had all the firms manufacturing gasoline engines in this country exhibited many times the space at present devoted to these would have been necessary.

For the first time in the history of the Exhibition machine tools in operation were shown. This is apparently only a start in the metal working line, and another year will probably see many exhibits of this class. Experts operating lathes and grinders were a new feature and correspondingly interesting. With the advent of a new Machinery Hall along the lines of modern construction such as has been incorporated in the new Process Building, and equipped with suitable cranes and transportation apparatus, a different interest would be taken by the machinery people in this country. It is noteworthy that of the machine tools exhibited only three manufacturers had exhibits, and of these two were from the United States. However, machine tools are a scarce article at the present moment, and few manufacturers are in a position to supply such for exhibition, being so far behind in orders that they cannot hope to catch up for many months.

As a strictly educational demonstration along industrial lines the exhibits in the Process Building are worthy of unstinted praise. The firms who have gone to the trouble to show the public how their particular lines are manufactured are deserving of every encouragement. May next year see many more added to the list. With a new Machinery Hall such features along a mechanical line would have a chance and the Canadian National Exhibition management would do nothing better than provide for such for the coming year.

USEFULNESS.

IN general a man's position in a community depends upon his usefulness to the community. The same is true in all walks of life. It is true in political life, although perhaps with some modification; it is true in social life, and it is particularly true in industrial life. To be useful to the highest degree a person or institution must have at heart and be in thorough sympathy with what it is desirous of accomplishing. Its incentive must be right and its motive the best. Failure along any line is very often not due to inability but to not realizing the field for usefulness in that line and making the most of it.

One of the greatest educational forces in the country, and with probably greatest scope for usefulness than other institutions, is the newspaper. They are of all sorts and conditions, all kinds and classes. The small

weekly plods along in its narrow field and the great daily spreads over many provinces. The class paper reaches its clientelle and the trade newspaper keeps its patrons alive to the conditions along their own line, from one end of the country to the other. In the latter class of paper there is a field for usefulness and more is probably being accomplished than in any other. To stimulate the growth of industry to keep alive the possibilities in manufacture, to inform the proprietor or general manager of a firm as to the best methods of buying or selling, methods of cost keeping, and the latest news that is taking place along his own line of development is performing useful service. To teach mechanical superintendents the latest in the technical world, to show the shop foreman and mechanic what is newest in machinery and how to best accomplish his work, and also features in fulfilling a destiny. When a man thinks he has accomplished his work when it is only half finished he can hardly expect to reap the highest reward for his services. When a newspaper goes only half way to reach the end towards which it should attain it is but half accomplishing a useful service. Trade newspapers are silent salesmen who get an audience with every issue. Their influence is in direct proportion to the influence of their audience. A newspaper going to double the field of another is twice as useful.

Most of our advertisers realize that the field of Canadian Machinery is a treble one. It goes to the man who owns and manages, it goes to the man who superintends and directs, and to the man who operates. In this way its sphere of usefulness is trebled. An advertiser has the possibility of the influence from three directions, all of which may be material in placing an order. This fact is significant. It is worth considering. It is, in fact, the fundamental consideration in connection with placing advertising. The advertiser reaps the benefit of influencing all possible interested in the placing of an order or the buying of goods, and means everything in the question of publicity from advertising.

ARE THE BRITISH WAKING UP?

DURING the past few years, when the United States manufacturer has established some dozens of branch manufacturing plants in Canada, the British industrial community has been an apparently uninterested spectator. Whether caring not or knowing not matters little, as the cold, hard fact stares them in the face that an opportunity has been missed that should have been grasped. They may make a move now to overcome an obvious mistake, but this lethargy cannot be overtaken nor the past recalled.

The fact that the announcement recently of a large Coventry firm's intention to establish branch works in this country came as a surprise to the manufacturing public here shows that the unexpected had happened. Whether it indicates a general appreciation of the possibilities in Canada on the part of British manufacturers, or is but an isolated case, is not known. It is, however, a recognition on the part of one wideawake concern, whose enterprise enables it to reach out across the ocean, that this country offers a field for manufacture.

The advertising we have received lately from various sources must some day start the ball rolling. When a general awakening has taken place, which must come, we predict a wholesale scurrying for sites and locations. In the meantime they seem satisfied to wait, and while waiting British manufacturers are making the same mistake as during the past five years in not looking ahead a little and exploiting the breadth and scope for various manufacturing industries throughout the Dominion.

LARGE PURCHASES FROM U.S.

WHILE the tariff preference with Great Britain arrested the decline of British trade with the Dominion, it did not prevent the enormous growth of Canada's trade with the United States. A comparison of the relative amount in iron and steel products show the enormously larger trade done in these lines with the United States as compared with Great Britain. A list of some of the lines shows for pig iron from Great Britain $247,406, and from United States $610,315. Bar iron and steel $289,961 and $565,870. Bridge and structural iron $2,119 and $717,165. Rolled edge bridge plates $4,199 and $402,576. Plates and sheets $189,417 and $712,448. Angles, beams, channels and like material $240,710 and $1,244,245. Hoops, bands, scroll and strips, $51,247 and $127,240. Railway fish and tie plates $18,604 and $151,828. Nails $4,615 and $160,708. Tubing $137,879 and $978,453. Wire $166,664 and $622,634. Nuts and bolts $7,528 and $116,084. Tools $47,099 and $772,470. Machinery $293,384 and $4,023,425. Gasoline engines $623 and $193,652. Pumps $3,706 and $199,016. Butts and hinges $1,341 and $59,016. Saws $5,473 and $168,783. Files and rasps $8,272 and $63,788.

The first figures in each case are those representing the amount from Great Britain and the latter from the United States.

Take the case of machinery alone. Over sixteen times as much is bought from the United States as from Great Britain, and about the same relative proportion of tools. Gasoline engines show even more marked difference, the amount from Great Britain being practically nil. In every line mentioned the difference is enormous, and enough to make the British open their eyes and wonder what it all means. One of the most prominent reasons is that United States manufacturers have an appreciation of Canadian business, are keenly alive to it and make special endeavors to secure it, while with our friends across the water, enjoying particularly favorable tariff privileges, this has not been true. The nearness of the United States is very much in favor of U. S. goods, and this probably offsets the British preference to some extent. Otherwise the difference seems to lie with the keenness for business and the enterprise in business circles between the two competing countries for Canadian trade.

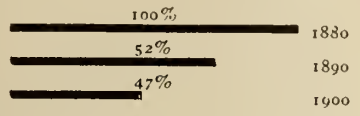
EXPORTS AND IMPORTS INCREASE

THE remarkable growth and prosperity of Canada is shown by the trade returns for the year ending June 30, 1906. The reports show an expansion both in the exports and the imports; and the increase in trade is not confined to any one branch, but is general. The total foreign trade for the year amounts to $552,000,000, an increase over last year of nearly $82,000,000, representing an increase of over 17 per cent. Of this foreign trade the imports entered for home consumption amounted to $290,342,408, an increase of over $28,000,000 over last year, representing an increase of over 10 per cent.; and the exports of domestic products amounted to $245,483,956, which is over $44,000,000 in excess of the year 1905, showing an increase of over 21 per cent. The exports of foreign produce show an increase of $9,000,000. The exports of domestic manufactures amounted to $24,561,112, an increase of $3,369,779 over 1905.

Profits and Needs of Machinery Manufacturers

By Myron Edward Evans, C.E., in Selling Magazine

MANUFACTURING operations are being carried on against a gradually contracting profit as judged by the returns per dollar of investment. Statistics giving the tendency in the matter of earnings of manufacturing concerns are difficult to secure. The United



EARNINGS ON MANUFACTURING CAPITAL AS COMPARED WITH EARNINGS IN 1880.

States Census Bureau compile statistics of the value of products, and report a number of items of cost and expense of manufacture, but specifically warn the reader that the difference between these figures should not be considered as the net profit of manufacturing operations in the United States. It is believed, however, that the figures so compiled may indicate, relatively, the profit secured in the manufacturing industries, and will be found of interest as disclosing the tendency to reduced margins, which has been experienced within recent years. Unfortunately the statistics for 1905 are not available to the writer, but the accompanying diagram will show the relative earnings in proportion to invested capital for the years 1880, 1890 and 1900.

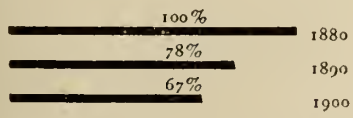
It will be observed that the profits have been apparently cut in two in the twenty years under consideration.

Less Business Per Dollar of Investment.

The decrease is partly accounted for by the decreased volume of business, which the manufacturer is able to carry with a given investment in capital.

Another cause is found in the decreased margin of profit on sales.

To offset this tendency, manufacturers have increased their investment, increased the volume of their business, and



SALES IN PROPORTION TO INVESTMENT, AS COMPARED WITH SALES IN 1880.

worked out operating economies for the purpose of maintaining fair uniformity in the results of their operations.

Increased Volume of Business.

Individual concerns show increased volume of business as follows:

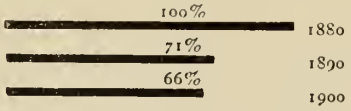
By this means and related efforts, they have maintained a practically uniform result, as will be seen in the diagram showing manufacturing results per concern.

The Iron and Steel Industry.

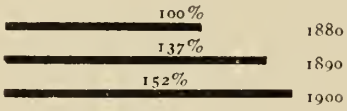
The great iron and steel industry, which includes the principal machinery manufacturers, when studied, shows a shrinkage in investment returns between 1880 and 1890, followed by a recovery in 1900. The volume of business for each concern, and profits per concern, both increased to a marked extent in the decade 1890 to 1900.

Machinery Manufacturer Secures Average Return on Investment.

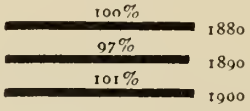
The machinery manufacturer secures about the average return upon his investment, as compared with the various manufacturing industries of the country. The following diagram presents the fourteen groups of industries, arranged in the



MARGIN ON SALES IN PROPORTION TO MARGIN IN 1880.



SALES PER CONCERN AS COMPARED WITH SALES IN 1880.



PROFITS PER CONCERN AS COMPARED WITH PROFITS IN 1880.

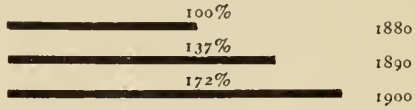
order of their profit in proportion to capital invested, as reported for 1900.

It will be observed that the iron and steel industry, embracing the principal manufacturers of machinery, stands at the average of the fourteen groups.

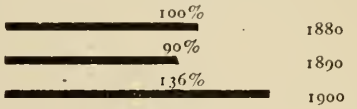
Becoming more specific, we find that certain of the machinery manufacturing lines, when compared with the average of the industries of the country, range as shown in the following table:

A Contracting Margin of Profit in Machinery.

The machinery manufacturer has worked against a contracting margin of profit and an increasing sluggishness of his capital, but secures about the average return on his investment. In considering his needs we are forced to the conclusion that they must be within the



SALES PER CONCERN IN THE IRON AND STEEL INDUSTRY AS COMPARED WITH SALES IN 1880.



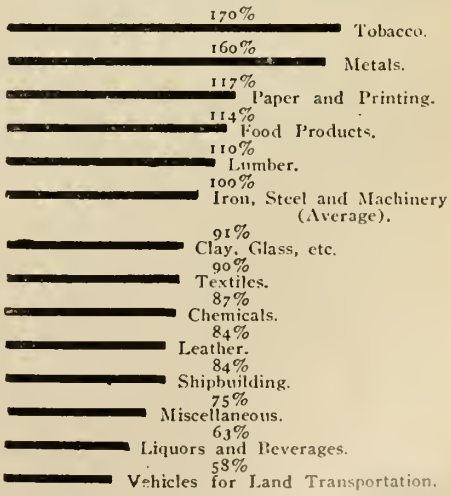
EARNINGS PER CONCERN IN THE IRON AND STEEL INDUSTRY AS COMPARED WITH EARNINGS IN 1880.

of output per machine or labor hour. These efforts contribute to economy in decreased cost of production; they also contribute in reducing the plant charge against machines made, which enables an increase in the activity of the capital scope of the terms "activity" and "economy."

Probably no industry has had brought to bear upon its problems more knowledge, skill or ingenuity than has that of the manufacture of machinery, in increasing its production through increase as judged by the volume of business per dollar of total investment. Production engineers and certified public accountants have developed a science of production and a science of cost finding, which have enabled the manufacturer to reduce his production costs to a remarkably low point.

Activity of Capital Dependent Upon Sales Department.

Improved machinery, processes, organizations and methods have accomplished



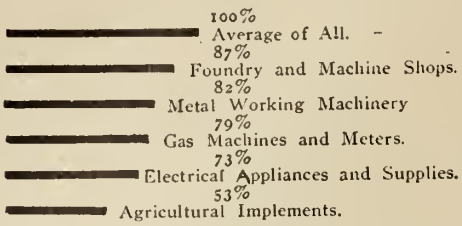
EARNINGS ON CAPITAL IN THE PRINCIPAL INDUSTRIES AS COMPARED WITH THE AVERAGE EARNING.

a marked betterment in results, but their operation has been largely up to the

point of what might be called f.o.b. factory. Beyond this point comes the department of the business having to do with the marketing of the machinery. The sales department is not yet a scientific institution. Upon its aggressiveness depends the activity of the concern's capital, as judged by the volume of business. Upon this department largely rests the grasp of margin premiums as distinguished from the bare margins, which the unscientific sales department is liable to be reduced to.

Full margins on sales, large volume of business, true economics in salesmanship, embracing the economies which contribute to profits and the expenses which do the same, these are a few of the problems facing the machinery manufacturer.

Thus far improvements have been quite



EARNINGS ON CAPITAL AMONG A FEW LINES OF MACHINERY MANUFACTURERS, COMPARED WITH THE AVERAGE OF ALL MANUFACTURING LINES.

large in the factory. Here the manufacturer is governed by more or less exact laws. So exact are they that competing concerns occupy closely competitive positions as regards cost f.o.b. factory. When it comes to the sales department, about the only law is that of the personal equation.

Ways and means of improvement are most difficult to understand, and require great business statesmanship to grasp and work out, but here is also the greatest opportunity. Margins are smaller when the way is clear, but premiums are possible to the concern whose sales department leads in true economic and scientific development. The next step in the line of improved manufacturing results will be found in the development of a science of selling.

Advertising of Manufacturers and Dealers

By W. HULL WESTERN; Manufacturers Advertising Bureau.

To one in business there is a wide difference in the status of advertising as it is regarded by the general advertiser and the seller of machinery, mechanical apphances and the like. With few exceptions the latter, using almost exclusively what are termed the technical and trade journals, doesn't take the matter of advertising very seriously. And this may explain much. There is a vague indefinite feeling that there is good in it and that it is the proper thing to spend something during the year to keep one's name up. And so the thing is done, but without any great expectations, or the expenditure of more than the minimum enthusiasm.

If, when the twelve months have passed, there are any convictions arising from the experience, it is the belief, more or less openly expressed, that advertising on the whole is a nuisance and altogether the most unsatisfactory thing the advertiser spends his money for.

And mostly he's right.

There is no going back of the fact that what one gets out of advertising is largely determined by what is put into it, and this in turn depends upon the degree of interest and enthusiasm which the work engenders.

It would seem that there is mighty little but money put into the advertising end of the business by the average machinery dealer to-day, and that is mostly just put in.

There are reasons, of course, why this is so.

Triple expansion engines, coal handling machinery and the like are not universal necessaries, to be sold by the gross or carload; neither do they suggest great possibilities as the basis for a mail order business. The trade from advertising products of this character must come most frequently in devious indirect ways (as it usually does) and its propagation calls for a full allowance of faith.

Clearly the situation does not make for the highest degree of enthusiasm.

Seldom, too, in manufacturing concerns is there anyone of the right calibre who really wants to attend to the matter; can't take the time from other duties; thankless job, and all that. And so the work is tossed from one desk to another, until it has gone the rounds of the office and become the most bedraggled and neglected part of the business.

Someone will some day take the time to give this important aid to the selling organization the attention it deserves, and so realize what a big and vital matter advertising really is and how much it can accomplish under the right conditions. For the present, few, even among those who have some real faith in its value, are willing to admit offhand that advertising can do much for one's own business as it has done for that of his neighbor in trade. And this because of the belief that his is a "peculiar" business and therefore one to which the usual usages and methods of procedure may not properly apply.

And what if it is granted instanter that this is so?

It simply proves what men of experience well know, namely, that every business must be considered of and by itself and the advertising adapted to meet the conditions which obtain in each individual case.

If users of advertising space in the technical and trade papers knew the good that would result from a systematic and dutiful attention to their advertising, instead of the happy-go-lucky way in which this end of their business is usually conducted, they would no longer miss the fine possibilities it affords.

Advertising is no longer all theory; much has been proved.

It has developed from a business man's rattle into a mighty serious business, and indeed comes very near to being a science.

Many extremely bright and ambitious men have been drawn to it, and have given it of the best that is in them. The result has been the uncovering of possibilities that cannot be over-looked by the serious, earnest merchant or manufacturer who would not only progress but survive.

In order, however, to go at the matter properly, one must recognize at the start that the advertising will not safely run itself; neither can its management profitably be intrusted to the tender mercies of a junior clerk or office boy. Also that it does not pay to make contracts for the fun of seeing one's name in bold type, or because the "solicitor" is persistent and a "good fellow." That really isn't good business.

More than all must come the conviction that it is necessary to give this department of a business the same thought, labor and financial support as is extended to others if the results are to be correspondingly satisfactory.

The matter of advertising naturally comes within the scope of the sales department and should be considered in

conjunction with it. Working in accord with the sales manager, the men on the road and the branch offices, it can accomplish much to the advantage of all.

Just as soon as the matter of advertising is talked about there is a noticeable quickening in the business life of a concern as a whole; when it is actually entered upon, the benefit is decidedly apparent. Every one appreciates the fact that something is being done by "those higher up" to push things, and each instinctively gets to work with a surer grip in the effort to make good."

The branch offices and men on the road gradually feel the movement of the vital forces in motion at the other end of the line, and strive in turn for a better showing partly from a natural pride in pulling their share, and partly that they, too, may reap the greater benefit from the help thus given, while it is to be had.

The result is a vim and "go" that breed dollars.

There is nothing else quite as sure for good in a case of "dry rot," threatened or arrived, as advertising.

Neither is there anything more reliable as a general business tonic.

The purpose of advertising, briefly, is to create new business and hold that which has already been created. And if it is of the right sort, it will do this. Advertising fathers opportunity for both buyer and seller. It brings one's product to the direct notice of the trade or the consumer.

Through advertising it is possible to reach many out-of-the-way markets of the world, where the man with the trunks and the grip-sack could not seek orders profitably. It will, moreover, pave the way in splendid shape for these hard-working pioneers of business as they wind their way through the great commercial centres, and make the catalogue, or other business literature which naturally follows, both welcome and of more than passing interest.

Beyond all this, an original, forceful line of advertising is proof convincing to the world at large that the concern back of it is a stirring and progressive one, that it is doing things in a big, broad-gauge, twentieth century way; and you and I and everyone else like to do business with just such people.

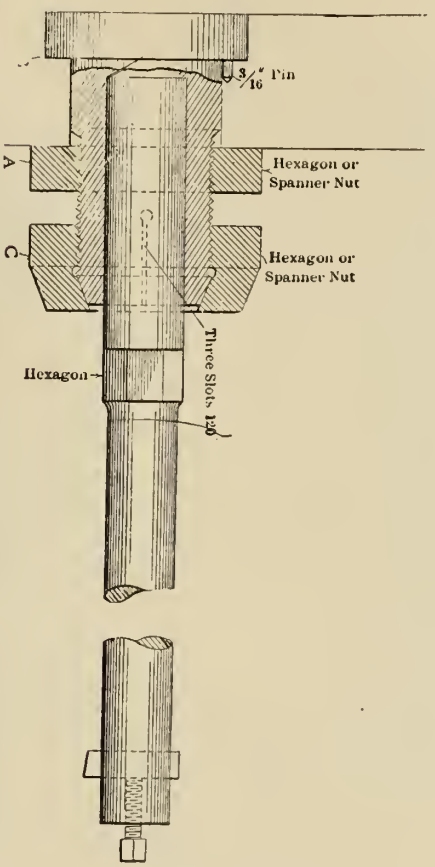
Seeing is still believing, mostly, and one feels that such folks are dependable.

Business conditions are changing, and where, as is so largely the case to-day, the buyer and seller rarely have a chance to meet face to face, there is no better or surer way for the seller to get known than by being fittingly and persistently represented in those publications which cover the various industries it is desired to get before and cultivate.

The acquaintance and reputation which can be acquired in this manner will often decide the direction in which orders are placed, and, of a certainty, cannot be gained as economically or expediously by any other means.

The value of advertising, also, for securing representatives in various and remote sections of the country should not be overlooked.

It very often occurs that business connections are made with individuals and concerns of reputation and standing who are led to seek an agency because of the vigorous advertising that is done by the enterprising manufacturer; which also makes his goods easier to sell than those less well known, and thus profitable to handle.



Key Seating Tool for Shaper.

The trade press as a whole is steadily making for a better average, and there is scarcely a profession, industry or field of commercial activity that has not its publications of worth devoted to its special interests.

One may, therefore pick and choose his battle-ground fairly, and plan the campaign for more trade to suit his inclination and his purse. It is thus made practicable to "try out" new or promising fields, and so size up the possibilities afforded before going into an expenditure of time and money which might otherwise attain large proportions and prove unprofitable after all.

Of necessity, to reap the maximum results from advertising, especially machinery advertising, the matter must be taken in hand in a serious, systematic and business-like way. It is all one man can do and do well, and to try to crowd the work in along with other duties is to invite failure at the start. The thing simply cannot be handled in such a way and be made to pay.

Advertising to-day is a big and growing proposition. It costs a good deal in time and money and needs a brainy man with tact, and a wide experience back of all to make it pan out satisfactorily.

There should also be judgment at command that is sound, a capacity for investigation and comparison of values, which comes only to a mind trained to the work, with the ability to take favoring opportunity as it may develop, and make the most of it in an advertising way.

All of which may be secured if the desire is both keen and sincere.

KEYSEATING TOOL FOR SHAPER.

By Herman Jonson, in American Machinist.

THE sketch herewith needs little explanation. The tool is used in the shaper or planer for keyseating pulleys or gears. It is made to fit the clapper block of the shaper and the only change or work on the machine is the drilling of one 3-16 hole for the pin shown. It is sometimes necessary to have a washer under the nut (A), where the head is roughened. The chuck (B) is made of machinery steel, case hardened, and the nuts and bar of tool steel. The hexagon on the bar serves two purposes; one for setting the bar, and second, where it is desired to plane a semi-circle it may be turned with a wrench. To plane a semi-circle the nut (C) is made just tight enough to hold the bar steady while it is rotated. It often happens in a shop that a piece larger than can be bored on the lathe can be planed in this way.

NEW GAS ENGINE COMPANY.

The Producer Gas Co., with Mr. G. P. Wallington, mechanical and civil engineer, as manager, has started business at 11 Front street east, Toronto. This firm have secured the Ontario agency for the Campbell gas engine and producer through Wayland, Williams & Dadson, of Montreal, the Canadian representative of the Campbell Gas Engine Co., of Halifax, Eng. The Producer Gas Co. are making a specialty of gas engines and producers of all descriptions.

Foundry Practice.

MODERN IDEAS FOR THE TRADE.

RECENT METHODS OF MACHINE MOLDING.*

By E. W. Mumford, Philadelphia, Pa.

I REALIZE that I have said and written so much about molding machines that anything more from the same source would be unwelcome, as lacking in novelty, were it not that, like any explorer of terrae incognitae, I have but to describe what I have seen to be credited even with originality.

It is because I feel that I can tell you of some new things and some new combinations of old things, which I think are to make the year 1906 one memorable in the history of machine molding that I venture to address you again.

I may as well mention the fields of development, taking up the detail in those fields as I go. You will at once say that the fields are well known.

Broadly, this is true, for they are as follows:—

1. Rock Over Molding,
2. Jolt Ramming,
3. Match Plate Molding,
4. Multiple Molding.

So far as I know, Rock Over and Multiple Molding by machines are ten years old. Jolt Ramming is over twenty years old, and Match Plates are the oldest thing in machine molding.

From the hinged flask to the first Rock Over Machine was but a step. Put the pattern on a Match Plate and hinge it from a point outside the flask area, with a counter-balance spring or weight to help handle the weight of plate and pattern, and a simple spring clamp to hold a bottom board on, and you have the earliest good seller in the Rock Over Machines. Its shortcomings are its radial pattern draft, which causes the pattern to bite off sand walls near the hinge especially, and the considerable error introduced by landing the mold on a more or less uneven bottom board. Mistakes have been made by designers putting brains and money into accurate pattern draft mechanism on machines, and afterwards vitiating all their designs by obliging their gear to draw a pattern from a mold which has tilted over on an uneven bed. You may know without trying that any machine that places a mold from which it is to draw a pattern on its back on a bottom board of any description and then draws the pattern regardless of the new plane of the mold joint will not be satisfactory on work involving any appreciable pattern drawing accuracy; and, even on the simplest work, if an absolutely clean lift is wanted, this inherent error will prevent it.

Before going further, I may as well state that much that I mention in this paper either is already or will be patented, the foundry trade should be grateful to our beneficent Patent Law that allows public use and advertisement of a new idea without sacrifice of a patentee's rights, for, by this condition, the trade get the use of the new machine just so much the sooner. It may be regrettable that enterprising foreign foster-mothers proudly adopt as their own promising American off-spring; but, after all, these infant wanderers seldom thrive away from home and the main regret is that they should be so abused and maltreated as to get an undeserved reputation for inanition. Of course, it is well understood by members of this association that it is best to avoid appropriating other people's ideas which are in process of development for patents, and I will, therefore, not hesitate to tell you some of the good things I know.

A decided improvement in Rock Over Machines has been introduced by giving the hinge of the Rocking pattern support a rectilinear guide intended to be normal to the mold joint in its line of draft. This has been a most valuable innovation, but at present has in it the fundamental error I have referred to, of trying to get a fair lift from a mold lying on a bottom board, with a fixed pattern draft.

There are several easy ways of avoiding this difficulty, and one of these is already in use. I refer to taking the datum for the pattern draft from the joint of the flask. The half flask lies on its back on its bottom board, and the pattern is drawn by guides resting on the joint edges of the flask. This is the correct method and deserving of success.

Jolt Ramming.

Jolt Ramming is 20 years old in this country. If you consider merely the bumping of a mold to ram or partly ram it Jolt Ramming is as ancient as molding, for all bench molders have had occasion always to pick up a flask and bump it upon the bench to settle sand in the pockets. But, practically 20 years ago, S. Jarvis Adams had power Jolt Ramming machines running in Pittsburg on small deep flasks.

So it is not, in itself, a novelty, though some of the early patents upon it having now lapsed, its public use is only recently being advertised.

The canons of success in Jolt Ramming are:

A dead drop,
A firm, solid machine,
Centre of impact under centre of gravity of falling mass,
Impact always central.

Until recently, Jolt Ramming machines which draw patterns as well as ram molds, have combined both functions in integral mechanisms and have been capable of ramming in only one way. Now, machines may be had which separate ramming and pattern drawing elements may, if desired, be separately and simultaneously used, and, as a consequence, a variety of pattern drawing elements—or what are commonly called "Hand Ramming Machines"— may be used upon a single Jolt Ramming element.

Most of the work which it pays to Jolt Ram is so deep that, to draw patterns, stripping plates are required. To change stripping plate patterns on a machine requires considerable time. It is, therefore, often convenient to keep a set of stripping plate patterns which are frequently used, permanently fixed upon a pattern drawing machine. Moreover, there is no good reason for keeping an expensive Jolt Ramming machine idle while men are changing patterns on a pattern drawing machine, which may just as well be separate from it. Furthermore, a man may purchase a single Jolt Ramming machine, and add to it a variety of sizes of pattern drawing machines, and even use several of them at the same time on a Jolt Ramming machine of sufficient capacity.

Ordinarily speaking, the cylinder of a pneumatic Jolt Ramming machine is only large enough to raise promptly the weight imposed upon it. There is, however, no reason why this cylinder should

*Read at American Foundrymen's Convention at Cleveland.

not also be large enough to press a mold and be subject to the control of an automatic valve for Jolt Ramming and, at the next operation, to an ordinary throttle valve for press-ramming.

To illustrate, take a grate bar. The pattern is all in the drag, and is of such a nature that Jolt Ramming is best, but the cope is "flat back," and must be rammed upon the drag mold and pattern, sand to sand.

This is something Jolt Ramming cannot to. The pattern in the drag will settle down in the sand away from the joint, so press-ramming is necessary. A machine is now built for this use.

Match Plate Molding.

I know you will say that this fell so long ago from the tree that the chestnuts cannot even be found in the burr! But don't forget that many a chestnut has grown a new tree.

Match plates date from the good old days when molders actually did their own thinking, and studied out ways to save their employer's time. Theirs is an honored name, yet so many troubles have been laid at the door of match plates either ill-adapted for, or misused in their work, that many a man quits listening when you say match plates to him and begins to do the talking himself.

Probably the first successful use of vibrators was in connection with single-sided match plates, and there have been many applications of the match plate since then to machine molding.

The making of match plates with patterns cast in their surfaces by a process which constitutes the plate a fin of ¼-inch or more around the casting of the pattern is very old, though not even yet known to all foundrymen. In forming the edges of such a plate, any desired shape may be given to the casting. For instance, about six years ago aluminum match plates were cast with rabbetted edges to fit frames surrounding them, which carried the vibrators and flask pins, and with that, now, there is little, if any, excuse for continuing the use of patterns feebly attached to the gates which run the castings.

This leads me to comment upon the fact that the match plate is deservedly rapidly displacing gated patterns in these days of speed in machine molding, for the gated pattern requires the sand match or odd side and separate ramming of cope and drag, which the match plate does away with.

Given a gate or spray of master patterns, and an aluminum match plate with edges fitted to go in a vibrator frame, may be prepared now in an incredibly short time by a new process which I am not permitted as yet to fully describe.

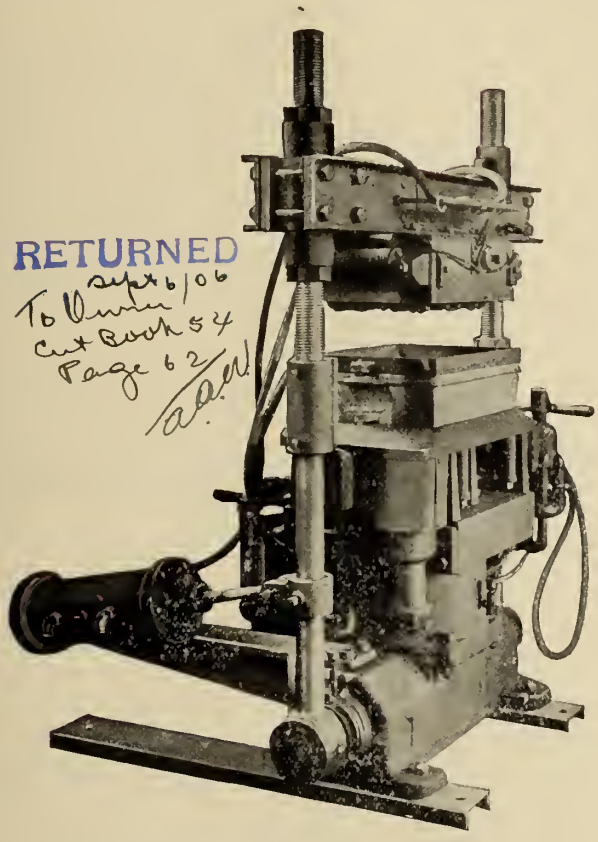
While speaking of match plates, if you will allow me I will mention an arrangement which is not yet completed and working, for the simple reason of lack of time, but the working of which is so simple, though, I believe, so novel, that I think you will pardon my speaking prophetically of its success.

It is simply a hinged match plate in a hinged flask. Hinged flasks are no novelty, and match plates would undoubtedly long ago have been used in hinged flasks, except for the disposition of the thickness of plate in closing, and the freeing of the hinge so as to get the match plate away. We give the flasks a double pin hinge and put the hinge of the match plate in one of them, so that the cope hinges on the plate until the pattern is drawn and then transfers its weight to its second hinge pin to free the plate. The plate is then hinged out of the drag and taken away, when its hinges are so arranged that the cope closes in perfect registration on the drag.

This method of molding avoids all handling of loaded flasks and reduces the "machine" to nothing but a match plate.

As a hinged match plate, however, it is limited to such patterns as will hinge out of both cope and drag, and is not for deep work.

If I presented no development of multiple molding beyond what has been known to the trade for some ten years,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Page 62

Fig. 1.—Rathborne Moulding Machine.

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Fig. 2.—Showing Minimum Space Occupied.

there would be little excuse for saying anything about it, but almost as much has been done in the last five years as was done in the first five of the approximately ten years of multiple molding.

The first multiple molds were just ordinary two part molds, piled one on another, with a sprue hole cut through the drag part into the cope part of the mold below.

Next came the thought of utilizing the idle joint between a drag part and a cope part.

It at once became evident that, in order to make this kind of multiple mold, it was necessary to ram both top and bottom faces of the multiple element simultaneously. This meant that the drag patterns should be rammed down into a block of sand while the cope patterns were being rammed up into it. The impracticability of pressing a pattern down into a struck surface of sand had, long years before, been shown in the operation of a machine in Scotland in which a double-faced match plate was swung in edgewise between cope and drag flasks, the drag flask already filled with sand, the cope flask filled with sand dropped upon the pattern. In this machine, just as in multiple molding, until recently, the greater depth of the pattern had to be in the cope, and for the same reason—the common difficulty of getting sand up around the pattern, against the universal downward tendency of all things.

In 1902 Mr. P. D. Beckwith, at Dowagiac, Michigan, made a great improvement in multiple molding by providing for filling the drag pattern while inverted and then holding the sand up against the drag pattern while turning it back upon the sand already filling the flask upon the cope pattern.

Although doing this accomplished for the first time the ramming of deep drag patterns in multiple, yet the time occupied in handling the drag patterns separately was sufficient to very much reduce the otherwise rapid machine molding. There remained, however, the large saving in floor space and in sand and flasks inherent in multiple molding.

It would surprise the many who carp at multiple molding as a fad that has run its course to visit Dowagiac and see the kind of work Mr. Beckwith is making in this way.

And now comes Rathbone, with his new principle of neutralizing gravitation by causing the unrammed sand in the flask with excess sand enough in the removable sand frame over the flask to allow for compression to move up against and around the drag patterns fixed to the ramming block of the machine with velocity equal to what it would have had if it had fallen in upon them.

By this means Rathbone sets the loose sand up around his pattern before ramming in an instant of time and just as effectively as though accomplished, as of old, upon an inverted pattern. In other words, he gets the drag mold practically instantaneously without the heretofore inevitable rolling over either before or after ramming.

If you will consider carefully what this means, you will see that a complete mold is formed by as simple and quick a process as is employed in other machine processes for forming the drag half alone.

As yet, the Rathbone process has been operated without time savers such as hopper-fed sand and automatically struck sand faces. But, notwithstanding this, sixty 14x16-inch or 13x18x4½-inch molds an hour are easily made by one man who shovels his sand from the heap and stacks his finished molds eight or nine high.

As a rule, the flasks used for multiple molding must be about 15 per cent. deeper than the half flasks used in ordinary two part molding. This is because each flask has half of the cope and half of the drag patterns in it, and must have sand enough in its depth to allow for this.

Work of about 2-inch total depth is usually piled nine molds high in flasks 4½ inches deep. That is ten flasks—nine molds—in a pile.

The saving in sand and flasks accomplished under these circumstances is :

$$.85\left(\frac{18-10}{18}\right)=37 \text{ per cent.}$$

The saving in floor space is :

$$\frac{9-1}{9}=88 \text{ per cent.}$$

Most foundrymen think that the castings at the bottom of a pile in multiple molding must strain, owing to the ferrostatic head of, say, 45 inches.

Two things should be considered before assuming this :

First.—That never were molds so perfectly clamped and weighted as those at the bottom of a stack of nine molds. If sand rammed as a liquid, and the same ramming pressure laterally as vertically might be assumed, the liquid iron would find walls of sand all about it set up at a pressure of at least 40 lbs. per square inch and held against displacement as never before. This iron, standing in a liquid column 15 inches high would exert a pressure less than 12 lbs. per square inch, so that, unless the walls of the molds yielded to such a pressure, and they would not, there could, even then, be no straining. But the second consideration is that the usual guarantee against strained castings is had by so reducing the section of the gate which leaves the metal to the mold as to insure its having set before the column of metal in the sprue has risen to a height sufficient to put an excessive head on the mold.

While there are many more new methods of machine molding which I might mention, I believe that in the main the most interesting have been referred to. The perennial search for permanent molds is being made and it is barely possible that, for light work, a permanent mold of refractory material that will allow a casting to shrink in it without pulling apart or that will follow the vagaries of cast iron in its process of crystallization may be discovered, but the problem is not an easy one, and I am inclined to think that for a long time to come green sand and a strong back or a good machine will produce most of our smaller classes of castings in large quantity.

INCREASING THEIR POWER RESOURCES.

The Montreal Light, Heat & Power Co., Montreal, are about to carry out a hydro-electric power development at Soulanges, on the St. Lawrence River. The contract for the installation of the hydraulic and electric machinery has been let to Allis-Chalmers-Bullock, Limited, Montreal. There will be three large turbines each with a capacity of 5,350 b.h.p. on the shaft under a head of 50 feet. To these turbines three 3,750 k.w. generators will be direct connected. There also will be two smaller turbines, each to develop 800 h.p., to operate the exciters. Provision is being made for the installation of a fourth unit of 5,350 b.h.p., when it shall be required.

A unique feature about the plant is that the draft tubes for the large turbines will be concrete construction, this being the first construction of this kind in Canada. The object in making the draft tubes of concrete is to decrease the coefficient of friction at the bends in the tubes.

Heretofore it has been the custom to get the castings for the water turbines for large installations such as this one from the continent and, therefore, the fact that Allis-Chalmers-Bullock are able to undertake the contract reflects considerable credit on Canadian industry in general, and Allis-Chalmers-Bullock in particular.

External temperature changes have no appreciable effect upon the operation of a mechanical draft plant which above all else is independent of climatic changes and conditions. The fan is a most important factor in smoke prevention, and in connection with the closed-fire room system the resulting ventilation is of vital importance.

The Molding Cutter

By T. C. Robertson, Galt.

THE subject of molding cutters, especially that branch which deals with the laying off of cutting edges, is one which should be of interest to molder men, and one which, owing to the geometry involved, is not always understood by the operators of these machines. After a little investigation any one can see that a knife the same shape as the molding would not make it accurately owing to being on an angle to the bed of the machine when it does the cutting; or in other words, if a knife is ground so that every part of the edge will touch the mold at the same time it will not reproduce the required shape although it may approach nearly to it.

As the head containing the knife revolves, the largest part of the knife strikes first, and then leaves the finishing line before the shorter portion comes into action, and in this way complicating the problem so that accurate work cannot be done without a great deal of cutting and trying.

Before illustrating and explaining a system of laying out molder knives let it be understood that the operator should choose a cutting line, and by a cutting line is meant the projection of straight knives with which the surfacing is done. The projection is usually about $\frac{1}{4}$-inch from the body of the cutter head. The method of laying out proportional drawings shown in the accompanying diagram is correct in theory, and when the operator has no other appliances except pencil and compass he can get it sufficiently accurate, especially if he has a good eye for form. It must be borne in mind in using this system that one scale will not do for heads of different diameter.

We will first notice the difference between the perpendicular or face of the molder and the slant of the edge of the knife, the first of which we have, the second we must obtain. From the cutting line (A) directly beneath the cutter head a standard scale is carried down say $1\frac{3}{4}$ in. with divisions of $\frac{1}{8}$ in. From the divisions on this scale are described arcs intersecting the line continued from the knife. From these intersecting lines are projections at right angle to the knife forming a new and different scale shown at (B). It will be noted in this scale that the allowance for the knife projection becomes less as the knife is extended farther from the head. This is the reason that the straight-edged bevel cutter will not produce a flat surface, but must be rounded in proportion to the decrease in projection allowed.

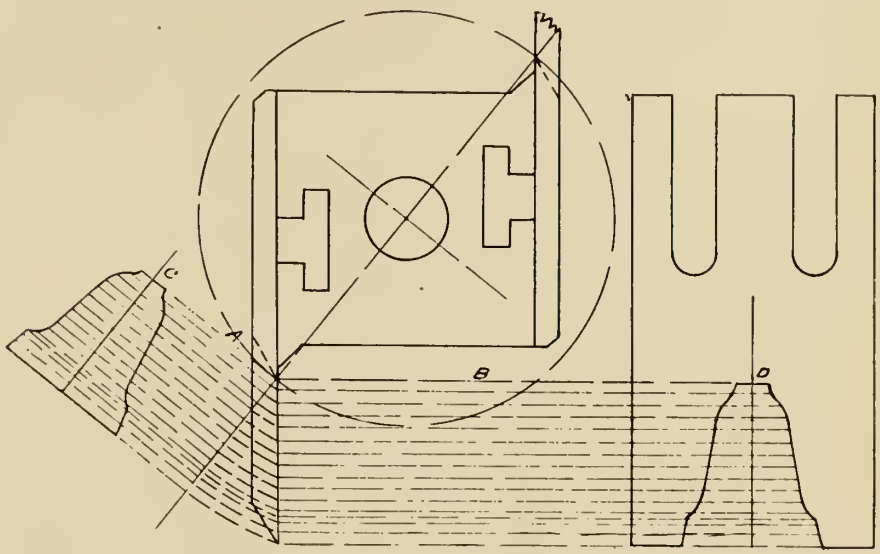
Referring again to diagram, the molding for which the knife is to be made is shown at (C), into which the lines from the standard scale are projected. A centre line is drawn through the molding corresponding to the centre line through the knife at (D). Measurements are now taken from this line on the various projected lines and transferred to the knife pattern at (D) on the new scale. At the intersections of these lines with the projected lines on the new scale is drawn the outline of the knife to make the required molding. It must be noted here that unless the scale be drawn with great accuracy the true curve for the knife will not be obtained.

All that is now necessary is to use a piece of sheet brass in laying out the curves obtained and use it as a template for the knives. A careful study of the diagram will show that it will not do for heads of different diameters, the variation being about 1-32-in. to every inch of projection.

The next step is to obtain proper blanks for the knives, and in selecting these we should be governed by the knives already in stock as we must arrange our combination so that we will have room to bolt several members upon the cutter head. Patterns should be so divided as to avoid inside corners wherever possible, as they must be sharpened with a file and so cannot be tempered as hard as is necessary to do good work. Knives for deep cuts should be as long as possible, for if the slots extend too near the edge, it will be hard to prevent springing, especially if the knife be a narrow one. When the blank is wider than the pattern to be struck it is usually better to have the surplus metal on the long side as it adds strength and gives less grinding.

In roughing out knives care should be taken to avoid encroaching upon finished lines. The surplus steel should be ground off on a bevel and straight across the edge to show the true outline. After the knife has been properly shaped it should be ground sharp without turning the edge, and the same precaution should be taken in merely sharpening them.

It is almost unnecessary to deal with the matter of tempering knives in this article. Experience is the only and best teacher. Considerable care should be taken to obtain an even temper, which is rendered difficult owing to the variety of shapes involved in different moldings.



Projections of Moulding Cutter.

NEW MANUFACTURERS' AGENT.

One of the latest firms of manufacturers' agents to open offices in Montreal, is that of Baxter, Patterson & Co., who are representing some of the best known Old Country manufacturers in machinery and hardware lines. J. L. Baxter, the senior member of the firm, has been for some time connected with L. N. Beard, manufacturers' agent, Montreal, and is thoroughly acquainted with the trade, both in Canada and the Mother Country. Wm. Patterson is also familiar with Canadian conditions, having been a member of the staff of B. & S. H. Thompson & Co., Montreal. Baxter, Patterson & Co. have secured commodious offices and warerooms at 102 St. Antoine street, where they will keep a full stock of the lines they handle.

Practical Questions and Answers

Cross Section of Boiler Tubes.

Ques.—What are the considerations which determine the cross section of boiler tubes, and their length relative to the cross section ?

Ans.—The area of the cross section of boilers must be sufficiently great to permit the free passage of the flue gases, and yet the area must not be so large that the gases will take a short cut through the tubes most nearly in line with the natural flow, else the rest of the tubes will be practically ineffective. Should this occur the gases will go up the chimney at an abnormally high temperature, and the total heating surface will not be utilized, resulting in the boiler being of less capacity than it was designed for. On the other hand, should the cross section of the tubes be too little, the flow of gases will be very sluggish, resulting in the depositing of an extra amount of soot upon the tubes, among others evils.

The diameter of the boiler tubes depends upon several factors and because of that no definite diameter can be fixed upon until all the conditions are known. The diameter of the tube depends upon the amount of hot gases which will enter the tube, and since that depends upon the draft, the diameter of the tube must depend upon the draft. Then again, the diameter of the tube being constant, the greater the draft the longer must be the tube in order to provide the requisite heat absorbing surface. Thus in locomotive boilers the tubes are small in diameter and long, while the tubes in a marine boiler are large in diameter and short. In fact, the whole question is involved in the problem of supplying the correct amount of heating surface to economically absorb the heat entering the tubes. In marine and ordinary boiler practice the sizes of tubes usually adopted are $2\frac{1}{2}$ inches or 3 inches in diameter.

Grate Area of Boilers.

Ques.—Upon what does the grate area of a boiler depend, and what relation does the heating surface bear to the grate area ?

Ans.—The requisite grate area depends upon two things chiefly, the kind of fuel and the intensity of the draft. The lower the grade of fuel the larger must be the grate area, and the weaker the draft the greater must be the grate area. With good coal comparatively low in ash, approximately equal results may be obtained with large grate surface and light draft and with small grate surface and strong draft ; although with Pittsburg bituminous the best results seem to be obtained from a rapid rate of combustion, that is, small grate surface and strong draft. With good bituminous coal and good boiler, a high rate of economy is secured with a rate of combustion of from 20 to 25 pounds per hour per square foot of grate surface, which rate of combustion may be obtained with a draft equivalent to that given by a chimney from 100 to 150 feet in height. Practically the same economy may be obtained by halving the rate of combustion and doubling the grate area. It is very advisable to do this where the coal burned contains a large percentage of sulphur, else there may be trouble with clinkers and burned-out grate bars.

The necessary square feet of grate surface per horse-power varies from 0.09 square feet to 1.25 square feet, as the rate of combustion ranges from 40 pounds of coal per square foot of grate area to 8 pounds, and depending upon the kind of fuel and the boiler. However, with ordinary bituminous coal, some authorities claim that not less than one-third square foot of grate surface should be allowed to secure the best economy.

The ratio of heating surface to grate area is a very variable quantity as may be readily understood when the varying rates of combustion are considered, but it is general practice among builders, unless the specifications call for something different, to allow 12 square feet of heating surface per horse-power. The ratio of heating surface to grate area can be worked out from the number of square feet of grate area per horse-power and the number of square feet of heating surface per horse-power. Then of the heating surface a certain proportion should be tube surface ; common practice seeming to dictate about 85 per cent.

Compression for Producer Gas.

Ques.—What is the highest compression that can be used in gas engines with producer gas without there being any danger from pre-ignition ?

Ans.—Higher compression can be used with blast furnace gas, because the composition of that gas makes it less liable to premature ignition than is producer gas. The compression to which producer gas may be subjected in an engine has been the subject for experimental work for the last few years. Professor F. W. Burstall, of the Birmingham University, Birmingham, Eng., has for the last two years been experimenting along this line with a 120-horse-power experimental gas engine in which the compression can be varied from 80 to 225 pounds per square inch, the experiments being conducted with Mond producer gas. The experiments have not been completed as yet, but the results of the experiments already conducted are of considerable interest. Experiments were conducted with the compression as high as 175 pounds per square inch. Up to that compression there was no trouble with premature ignition, due mainly, Prof. Burstall says, to the thorough scavenging of the cylinder and the simple shape of the combustion chamber. This is, of course, a much higher compression than has been used with producer gas except when water injection has been used to cool the charge. These experiments seem to show that with a properly scavenged engine very high compressions may be secured, and Prof. Burstall makes the propheey that the gas engine of the future will use very high compression, probably as high as 350 to 400 pounds per square inch.

NEW SMELTING PROCESS.

Australian inventors claim to have perfected a new process for the treatment of iron ore. This method, called the Heskett-Moore Pattern, was given a test recently at Melbourne, where operations were in full force for the treatment of ferruginous ore for the manufacture of iron and steel, by a direct and continuous method of manipulation. A number of experts present expressed the opinion that the trial was most satisfactory, and that the process would revolutionize iron and steel manufacture.

BUFFALO FIRM TO BUILD IN CANADA.

In reply to an enquiry by Canadian Machinery, the Buffalo Tool & Machine Co., dealers in machinery, Buffalo, state that they are preparing plans for the construction of a six-storey steel building at 172 Front street west, Toronto. The building will have a frontage of 45 feet and a depth of 119 feet, and will have facilities for the handling of machine tools and woodworking machinery of all kinds, both new and second-hand.

It is also the intention of the company to manufacture a line of woodworking machinery, such as band saws, jointers, planers, etc.

The business will be organized and carried on under the name of the Buffalo Tool & Machine Co., but will be a distinct corporation from the Buffalo firm.

Tricks of the Trade

Everybody is invited to contribute to this page. Send in your ideas, odd jobs you are doing, and anything of interest to fellow-workmen. Remuneration will be made for such contributions. [Ed.]

SYSTEM IN KEEPING TOOLS.

VERY few large machine shops have not a system, more or less elaborate as the shop may require, of keeping track of tools that are used by the mechanics throughout the shop, but in the smaller shops this is not so. However, there is as much need for a simple system in a small shop as there is for a more complicated one in a large shop, and for that reason the following description of a simple system being adopted in a small Canadian machine shop will be interesting and, perhaps, suggestive.

Before this system was adopted free aecess was had to the tools by every mechanic, and consequently no person was responsible. One need not have been on the spot to know the result of that. Sometimes tools were replaced and sometimes not; nor could one find where a tool was without making a tour of the shop, thus losing considerable time and patience. Then, too, it is not good for tools to be lying anywhere and everywhere around a shop, as they would be where no person is responsible for their return; and again, the careless would be led to be still more careless since the "boss" would not necessarily know about the breaking of a drill or the smashing of the teeth in a milling cutter.

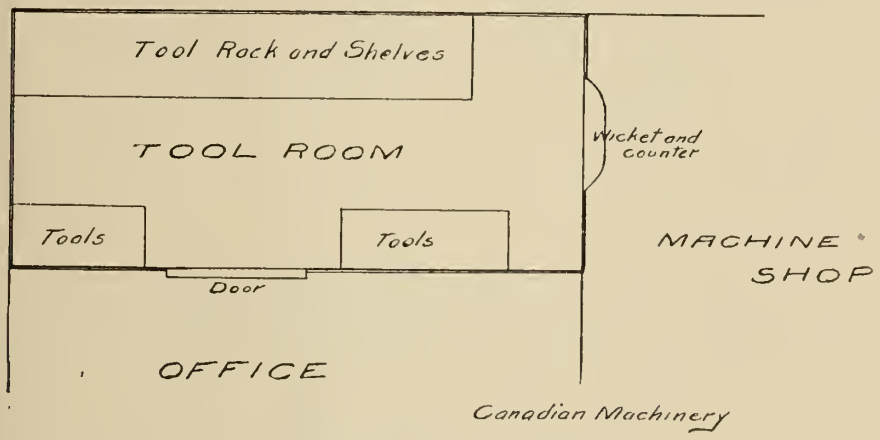


Fig. 1.—System in Keeping Tools.

The chief reasons for having a system of looking after tools are to save time and to prevent any unnecessary wear and breakage of the tools. To carry out these ideas there must be a tool storage room, admission to which should be allowed to no one but the person in charge. In this tool room should be a place for each tool, and when that place is not occupied by the tool there should be some record to show where it is. Under these conditions no tool is ever lost track of, and someone or another is responsible for its safety at all times.

In a small shop the number of tools is not great, and the system required need not be at all complicated. In the first place, the tool room should be so situated that the person appointed to look after it will lose as little time as possible in attending to the needs of the mechanics and getting back to his own work. The tools should be so arranged as to be easily seen and handled. There should be some system of numbering the tools, the number being marked on the tool in some way and also on its position in the tool room. Sheets should be made out with these numbers on them, and when a mechanic takes out a certain tool he should be required to place his initials or his check number opposite the number of the tool on the sheet, and when he returns the tool a line can be drawn through the initials or number. In a small shop this would probably be found satisfactory, as there would not be such a number of mechanics as to make it difficult to find a man by his initials, but, of course, if check numbers are employed there should be a key to them made out for the tool room.

Figure 1 shows the layout and position of the tool room with respect to the rest of the shop. As is seen, there is a wicket and counter between the tool room and the machine shop, where application is made for tools. The tool room is attended by someone in the office, the door being placed as shown. There is a push button placed on the counter connected with an electric bell in the office, which is used as a call bell. There is a solid partition between the office and tool room, but above the counter between the machine shop and the tool room there is wire netting, which effectually closes off the room without shutting out the light.

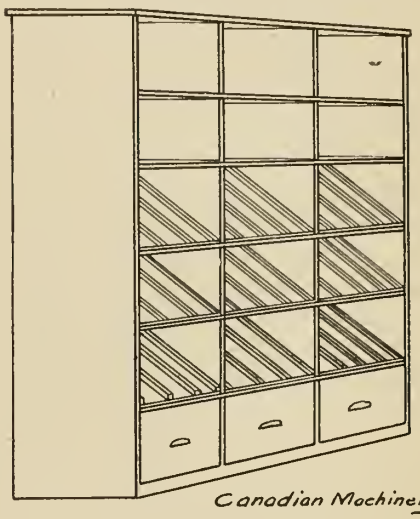


Fig. 2.—System in Keeping Tools.

The room is lighted efficiently from the office and shop. Figure 2 represents the style of shelves used to hold the tools, the sloping, grooved shelves being used for such tools as taps, drills, files, etc., while the drawers are used for small miscellaneous tools and supplies. Figure 3 shows the manner of keeping milling cutters. It consists

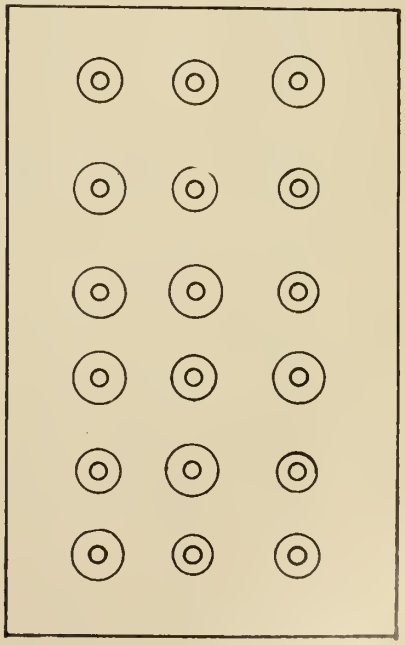


Fig. 3.—System in Keeping Tools.

merely of a board provided with spikes over which the cutters are hung. In this system the tools are arranged in convenient classes for storing, each class being kept by itself and donated

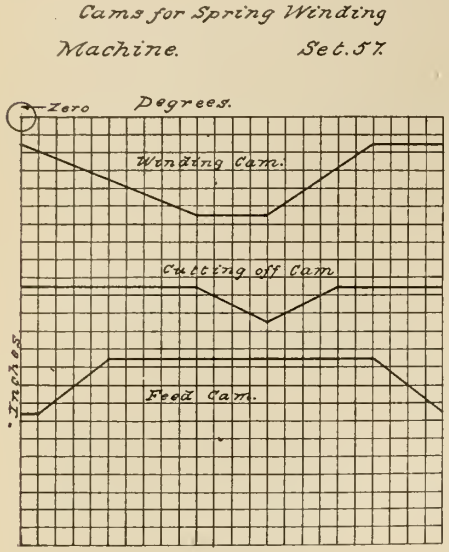


Fig. 1 —Keeping Cam Records.

by a letter of the alphabet. Each tool in the class is denoted either by its size or by a number. Each department of the shelves or room devoted to a class of tools is labeled with the letter denoting that class, and each tool in a class has a place, and that place is denoted by the number or size of the tool, and the tool itself is marked with its group letter and with its number or size. Sheets are made out on which are printed the tool numbers or sizes grouped in their respective classes, and when a mechanic gets a tool he makes his initials after the tool number or size, and upon its return a line is drawn through his initials, relieving him of all responsibility. Thus a tool cannot be lost or broken without some person being responsible; nor is time lost in hunting for tools, since if the tool is not in the tool room the mechanic having it is known from the sheets.

The tool room in a small machine shop might also be used as a storeroom, and a store's system be arranged in conjunction with the other system.

J. C. A., Toronto.

KEEPING CAM RECORDS.

IN these days when records are kept of almost everything immaginable in both office and factory regarding cost of production, time, etc., it would not be out of place if another leaf were added to the book and a record kept of the anatomy of the different machines.

I do not intend to make any analysis of different kinds of cams or their value for different work, but simply to show how system in connection with cams, as with anything else, is a time-saver.

In designing a machine, after the different parts have been roughed into place and the cam shaft located, a set of cards similar to Figs. 1 and 2, should be made, to some scale as ¼ in. to 1 in. The card should be inked in, also the zero point, after which the cam parts should be laid out lightly in pencil. This allows you to see that no cam interferes with another, and also allows you to divide up the revolution of the cam to suit the different work done by the tools connected to it. After this has been done a card like Fig. 2 should be made, one for each cam, and the cam paths penciled in. If the curves are shown to be too severe changes must be made which should be recorded on Fig. 1. When the paths of the cams have all been laid out so that

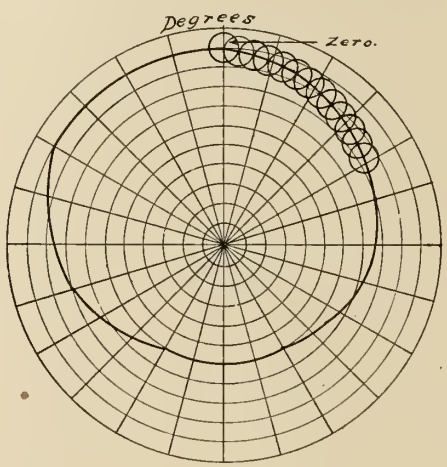


Fig. 2 —Keeping Cam Records.

the curves are soft and timed not to interfere with one another, they should be inked in and any notes which may be considered of value for future reference made on the back of the card. A number is now given to the set, and it is filed away in a book of the loose leaf style under some heading suitable for this style of machine. In the case given in Figs. 1 and 2 they, with the rest of their set, would be filed under the heading of "wire machinery."

Should any change be made at any future time they should be recorded in a note on the back of the cam the change has been made on, and the change marked in on both Figs. 1 and 2, in a different colored ink. By doing this you have a complete history of each cam on its own card in Fig. 2, and also a complete record of its relation to all the other cams on the machine in Fig. 1.

Should a similar machine have to be built at any other time, or should it have to be modified to do some somewhat different work, involving more cams, by looking up the cam record you can at once find where the change can be made, and then, too, the notes on the back tell how the different cams are situated as regards time, and you can at once see whether they have any to spare. This informs you in an instant just which cams can be crowded and which cannot be crowded.

Much other information as well can be kept, such as a record as to which is the best style of cam, barrel or face, for any particular work; the best size of roller and length of face; the best speed for such a cam, whether positive or spring return, and many other notes which may come to you as you lay out the cam.

H. GEARING, M.E.,
Toronto, Ont.

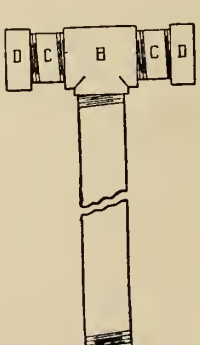
PISTON AND SLIDE VALVES.

The object of piston valves originally was to take the place of large slide valves which could not be made tight and were therefore ineffective. In action the piston valve decreases the friction and increases the port opening for the same space occupied by the valve. A typical shape of a piston valve is a D slide valve wrapped in the form of a cylinder.—Compressed Air.

HAMMER MADE OF PIPE.

A very handy hammer can be made for little or nothing, provided one has a few old materials on hand.

Into a ½-in. tee (B) screw a piece of ½-in. pipe (A) about 8 in. long with threads on one end and two pieces of ½-inch pipe (CC) 2½-in. long with



Hammer Made of Pipe.

threads on both ends. On the ends (DD) put ½-in. caps.

A larger hammer can be made by using pipe of larger dimensions, and the hammer can be made heavier by stopping up the tee and filling the head with lead.

Mechanical Reviews

OPINIONS AND STUDIES WORTH NOTING

AN EXPERIMENT IN MILLING.

THE object of this experiment was to determine whether there was any saving in milling two rows of castings, of the shape illustrated in figure 1, set side by side, over milling a single row.

The machine used was a No. 5 Cincinnati milling machine.

The arbor and cutters are illustrated in figure 2. In milling the two rows a second gang of cutters was used on a longer arbor, with a support between the two gangs, using, however, the same diameter of arbor. These cutters were

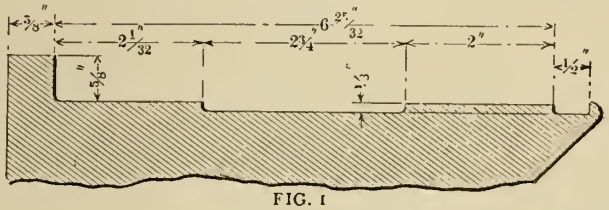


FIG. 1

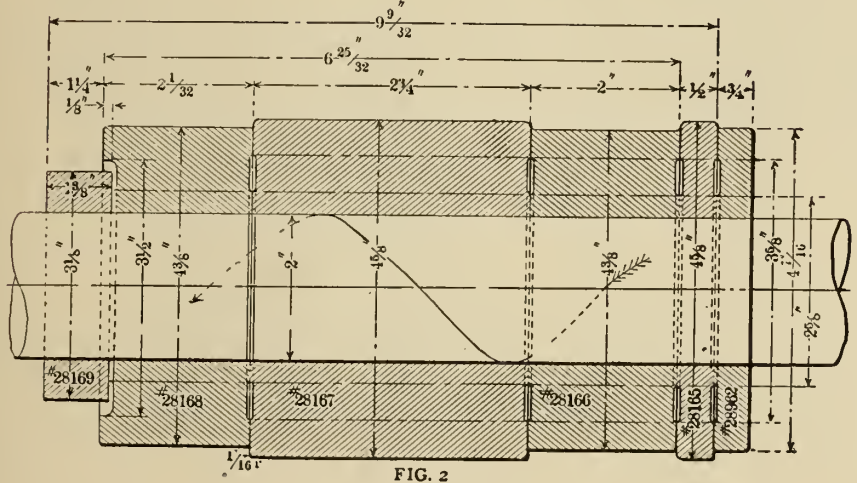


FIG. 2
An Experiment in Milling.

made of high speed steel, and in both cases the machine was pushed to its full capacity, consistent with obtaining work free from chatter. The size of the arbor was limited to two inches by the size of the tapered end, and the latter was once twisted off in the experiments with double rows.

From the experiment it was found that a cut of 0.247 inch per revolution of cutter was the most practical limit for milling the single row, this being equivalent to a table travel of about four inches per minute, for a total width of cut of about 8½ inches, and average depth of cut about 5-32 inch.

For the double rows it was found that 0.098 inch was as fast a table travel as was practical with the same speed and feed of cutter, or about 1½ inches travel per minute; for a total width of cut of about 17 inches; and while the time consumed in setting up the two rows was a little less than twice that for setting up one row, this saving was so slight that it did not at all offset the longer time for milling. In both cases we worked up to the pulling capacity of the belt, a four-inch double belt, and in fact were overloading it.

With the single row we were removing roughly 5.3 cubic inches of metal per minute; with the double rows only 4.2 cubic inches.—"Ford," in American Machinist.

GAS ENGINE VALVE CONSTRUCTION.

IN designing machinery it is important to consider each detail in the light of the service or duty required of it. Too often the inventor, anxious to achieve the end sought in the machine itself, neglects the correct designing of its parts, as a consequence of which the machine is no sooner completed than it has to be redesigned. It may be that on trial some detail gives out, or it may be only that some difficulty in manufacturing has not been foreseen. Either is sufficient to discourage the capital the inventor is endeavoring to interest.

To design and lay out an inlet or exhaust valve for a gas, gasoline or oil engine, consideration should first be given to the requirements of each section. Allowances must be made for the forces tending to fracture the material of which the valve is made and the tendencies to destroy surfaces of bearings or seats. A typical valve might appear as shown in Fig. 1 of the illustration. Beginning at the thread end, this should be of a composition such that the thread will not change its form and thereby cause the nuts to tighten or loosen when the valve is in service. If collars are substituted for nuts the stem should not upset and make it difficult to remove the collars for cleaning and repairing. If an analysis does not show a proper proportion of the elements it may be expected that the stem will be likely to bend under the stress of service and cause the valve to remain open from friction in the guide. Of course the dimensions are to be considered as well as the composition. A bending of the stem would tend to throw one side of the disc or valve proper off its seat, thereby destroying the compression to a degree that would result in a poor performance of the engine.

The expense of machining the valves must also be borne in mind to keep down the cost, not only of the complete engine, but the selling price of the valve when ordered for repairs. A great deal of new business has been lost simply through the high prices charged for detail parts. Valves of this style, with stems up to 1 1-2 in. in diameter, may be finished in a monitor or turret lathe at a very low figure if the stock is suitable in composition. For the threaded end (A) of a valve the following composition is recommended:

	Per cent.
Carbon	0.16
Silicon	0.11
Sulphur	0.034
Phosphorus	0.029
Manganese	0.51

The next section to be considered is an important one—the body and wearing section (B). On it depends the keeping of the valve in position, without noise, caused by lost motion in the guide. This section should be as hard as possible without sacrificing other important features. A fairly high grade of tool steel, with, say, 0.65 per cent. carbon, will give good results, as it may be hardened and ground true to gauge. The uncertainty of lubrication at this point in the engine makes a hard section desirable. In the making of these valves it is good practice to rough out all parts to within about 1-32 in. and then anneal the stock, before grinding to size, to remove all strains that may cause trouble when subjected to the temperatures of the engine cylinder and valve chest.

At this point it might be well to emphasize the importance of finishing all valves strictly to gauges and make them standard. It means much to the purchaser, as it allows him to make repairs with very little loss of time. Equally essential is it that provision be made for wear in the valve chest by the use of a bushing ground to gauge, that may be renewed when the new valve is put in.

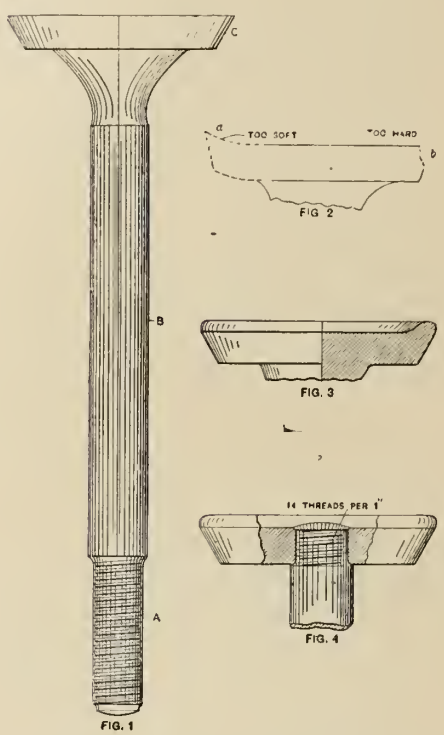
The last section of the valve, and the one that gives more trouble than any other, is the valve disc. If the material is too soft the edges will turn up, as shown at (a) in the detail, Fig 2; if too hard they will crumble and break off, as shown at (b). There is also a tendency to cutting at these points from the action of the exhaust gases, which will be considered later. To reinforce the disc edge and give strength to resist destruction a change in design, as shown in the second detail, Fig. 3, will provide additional stock, but not enough to materially increase the weight of the valve, a matter of moment in a high speed engine. Good results for medium speeds are secured with a composition showing:

	Per cent.
Carbon	0.12
Silicon	0.11
Sulphur	0.041
Phosphorus	0.053
Manganese	0.34

To construct a valve as described above recourse is had to electric welding and grinding for finish. A valve may be built up, as shown in the lower detail, Fig. 4. that will give good service and at small outlay. The disc may be made from a good close grained gun iron and the stem from steel showing a composition of

	Per cent.
Carbon	0.16
Silicon	0.11
Sulphur	0.034
Phosphorus	0.029
Manganese	0.51

The body or guide may be case hardened, leaving the two ends soft. This can be readily accomplished by packing the stems in hardened boxes, with the hardened compound surrounding the bodies only and the ends covered with clean sand. The thread in the disc should not be coarser than 14 to the inch in valves up to about 3 in. in diameter. The discs should be put on hot and the stem riveted over.—H. S. Brown, in Iron Age.



Inlet and Exhaust Valve Showing Details.

DETERMINATION OF PHOSPHORUS AND ASH IN COKE.

As every chemist knows, who has coke analyses to make, the methods in use at the present time for the determinations of phosphorus and ash are very long and tedious, and a method which would considerably shorten these determinations would be welcomed.

The method here given first originated in the laboratory of the New Jersey Zinc Co., Hazard, Pennsylvania, and has never to my knowledge been in print.

Ash.

Brush one gram of finely powdered coke into large weighed platinum dish of about 150 cc. capacity; add enough absolute alcohol to sample to make a thin paste. Now revolve the dish slowly so as to cause the thin paste to run up along the walls of the dish. Keep up this motion until all the alcohol is evaporated and there remains only a thin film of sample over the walls and bottom of dish. Now place the dish over a blast lamp, or in a muffle furnace, and in five to seven minutes the carbon will have been entirely burned off, the ash remaining. Weigh and calculate percentage of ash.

Phosphorus.

Five to ten grams of sample should be taken. Proceed as in ash determinaion. When the carbon has all been burned off, add to the ash in dish 10 cc. of dilute HCl and 29 cc. HFl. Evaporate to dryness under a good hood, but do not bake. When cool add 15 cc. of HCl and heat. The residue should all dissolve, but a little insoluble matter may be filtered off and neglected. Pour the solution into a flask, add NH_4OH, then HNO_3, and then molybdic acid solution, and "shake down" phosphorus. The yellow precipitate may be either weighed direct or titrated.—John F. Hoy, in Iron Trade Review.

RELATIVE POWER OF TWO AND FOUR CYCLE ENGINES.

S. M. HOWELL, in the Gas Engine, says that it has been his experience that two and four cycle engines of the same size and both of the best possible construction will develop about an equal amount of power, up to 700 or 800 feet of piston speed per minute, but beyond that speed the four-cycle system will defeat the other, and at the highest practical speeds will develop about 25 per cent. more power. At lower speeds, however, say up to 500 feet per minute, the two cycle will frequently show as much as 50 per cent. more power than will the four cycle engine of the same bore and stroke.

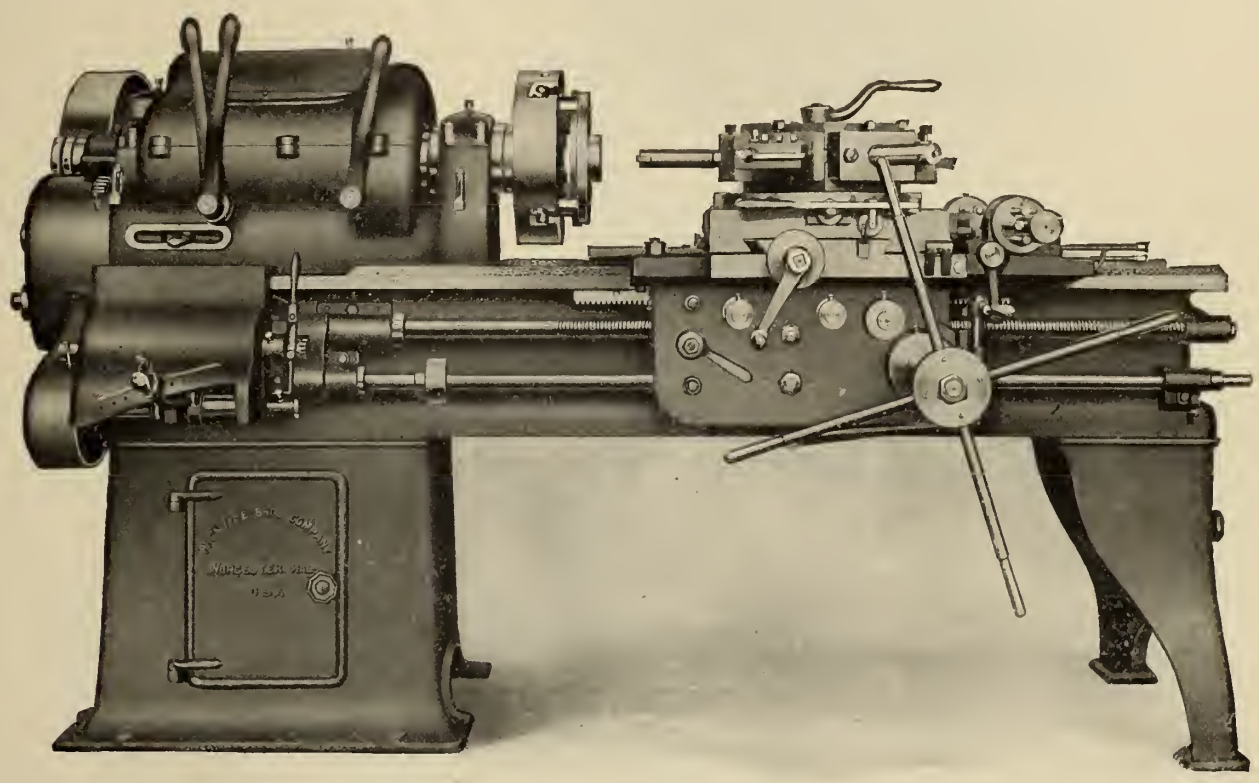
It will be convenient in estimating the amount of coal for hoisting engines and the like, to use the following figures: Allow one-third of a ton of coal for each 10 h.p. per 10-hour shift. This rule holds good for most engines up to 80 horsepower.—Compressed Air.

For removing sand from small brass castings, hydrochloric acid one part and water ten parts makes about the best solution that is used in ordinary practice.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

NEW PRENTICE TURRET LATHE. THE accompanying illustration is of the new geared head high speed turret lathe recently placed on the market by the Prentice Bros. Co., Worcester, Mass. The machine was designed especially for the rapid machining of cast iron parts such as gears, pulleys, etc., which require two or more operations. The lathe has a 15-inch swing. The geared head gives eight changes of speed, and it is provided with a change feed gear box giving thirty-three different feeds. The turret is hexagonal and



New Prentice Turret Lathe.

of heavy construction, and is provided with hand and power cross and longitudinal feeds, with adjustable stops for feeds in all directions. There are six stops for the longitudinal feeds, which revolve automatically with the turret, or which may be used independently by disengaging the stop drum, thus rendering it possible to use one tool for more than a single operation. The cross feed has twelve adjustable stops, six in either direction, which are operated independently of the turret. All stops are numbered. The wide range of cross traverse makes necessary the wide range of speeds provided in the head.

To provide for rotating the drum carrying the six adjustable stops for the longitudinal feeds when the turret is rotated, an interesting mechanism is employed, which is independent of the crosswise position of the turret. On the bottom of the turret is cast a large bevel gear which meshes with a bevel pinion splined to a shaft extending at right angles to the bed, the pinion being free to travel on this shaft when the carriage is fed crosswise. The ratios between the gears is 7 to 1, and hence for each 1-6 revolution of the turret the shaft will make 1 1-6 revolutions. The shaft through miter gears transmits its motion to a longitudinal shaft, which is connected by spur gears to the shaft of the stop drum, giving to the drum 1 1-6 revolutions to each revolution of the turret, which brings the proper stop into position for each position of the turret.

The apron is so arranged that the operator may start, stop or reverse both the longitudinal and transverse feeds at will. The longitudinal feeds are tripped automatically by a mechanism behind and at the side of the apron. To reverse the feed a spring stud dog is turned through 45 degrees which permits it to pass its stop. This causes the clutch in the apron to engage the opposite bevel pinion which reverses the feed. This device operates the reverse for both feeds.

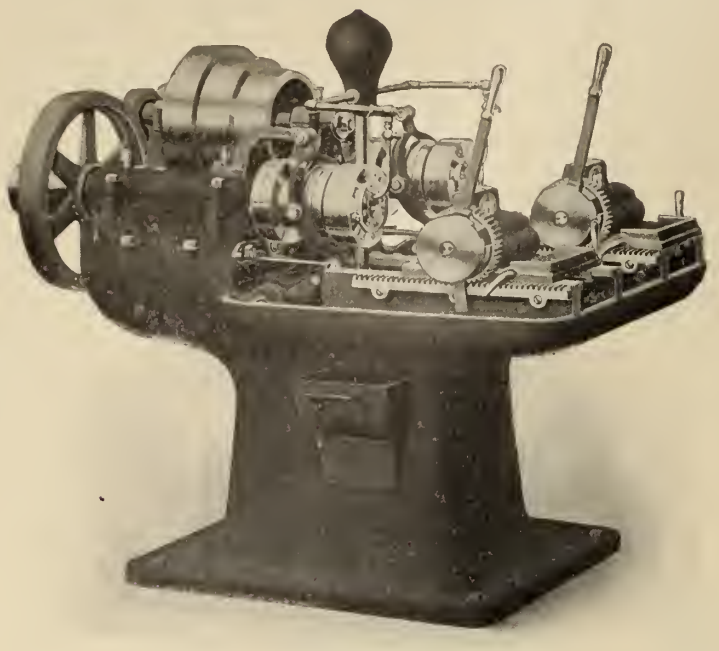
The lathe is provided with a screw which will permit the cutting of any standard thread. A simple locking device is provided to prevent the simultaneous engagement of the separable nut on the feed screw.

More detailed information regarding the operation of the lathe may be had from the makers, Prentice Bros. Co., Worcester, Mass.

A large new saw mill will be erected in New Westminster by a number of American capitalists, headed by C. R. McLaughlin, Columbus, O. The site for the mill has already been cleared, and extensive timber limits have been secured.

SPINDLE BOLT CUTTER.

HEREWITH is illustrated a double bolt cutter made by the National Machinery Co., Tiffin, O., and a view of the "National" head used on all the National bolt cutters is also shown. The points claimed for these machines are: Their ability to cut a thread of uniform diameter, thus giving perfect fit, and the thorough handiness of operation.



National 1½-inch Double Bolt Cutter.

A description of the operation of the head will be of interest. The head consists essentially of: A main body or barrel, a die ring resting on the barrel near the end, which moves back and forth over the dies, forcing them in or out by means of their inclined tops; two rocking levers or dogs which determine the position of the die ring; and a clutch ring, controlling the dogs.

With the head open, if the clutch ring is forced forward, it slides over the curved upper sides of the dogs forcing them to swing inward, and they in turn push the die ring forward, sending the dies toward the cutting position; when this position is reached the clutch ring moves onto the shoulders of the dogs and effectually locks the head.

These two shoulders then being parallel to each other no amount of outward pressure against the dies can force the clutch ring back, and it is prevented from working off by two spring-cushioned spline screws that pass between it and the die ring. These screws also serve to pull back the die ring in opening the head, and the springs both eliminate lost motion on the die ring, and prevent any cramping on the dogs when opening.

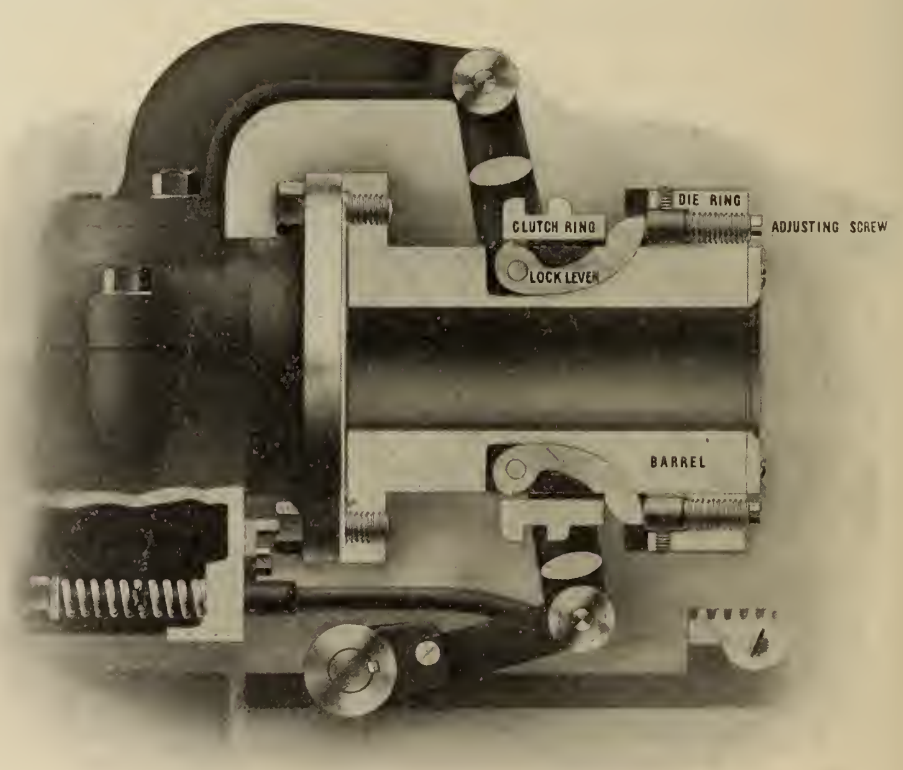
The noses of the dogs do not bear directly on the die ring but on large ends of the adjusting screws. Obviously, when the screws are turned one way or the other the location of die ring on barrel is correspondingly altered, and here is where minute adjustments for under or over size diameters are made.

To change dies, a catch on the front of the head stock is simply thrown, which permits the die ring to move backward until it entirely clears the backs of dies, and these can then be readily removed and others substituted.

The barrel, clutch ring and die ring are semi-steel; the dogs and adjusting screws are hardened tool steel; the inclines in the die ring and several other contacts are protected by tool steel inserts.

Once closed, the head is practically as solid as a single piece, and such wear as can occur must be during opening and closing operations. The dies are braced against the head itself. Lost motion in the head is prevented through the spring or weighted contacts on the locking device, and lost motion outside the head can not affect the diameter of the work. For instance, end play in the machine's spindle will not matter provided it does not exceed ¼ inch or so, and this amount would simply trip the head.

Lost motion is fatal to the cutting of good threads. When the operator closes the dies he does it quickly, and the head and all are thrown forward, leaving the dies too far in, if slack is present. Then when the cut begins the diameter will be undersized, and one or two nut thicknesses will have to be threaded before the dies are finally forced back to a solid support. And this means that a nut will not fit right where it will probably rest—near the bolt's end.



View of National Head, Dies Closed.

The Philip Carey Co., of Lockland, O., are negotiating with Brantford with a view to establishing there. They manufacture felt roofing, etc.

PLANER TYPE MILLING MACHINE.

THE accompanying cut is of a planer-type of milling machine developed by the Becher-Brainard Milling Machine Co., Hyde Park, Mass., to provide for the demands of modern milling machine practice. Special attention has been given in the design to secure strength and rigidity of construction.

The spindle is made of hammered crucible steel, has a threaded nose and runs in self-centering bronze boxes with nut and check-nut to compensate for wear. The spindle carrier is very heavy and is held firmly to the upright by long gibs. It is elevated by a screw with adjustable dials graduated to thousandths of an inch and has counterbalance for ease of operation. The spindle has 20 changes of speed, and by means of hand lever and quick change gearing, the speed is easily adjusted.

The table is very heavy and is regularly built with five T slots lengthwise and an oil channel the full length and at each end. It travels on flat ways securely gibbed and has a quick return operated by power from a separate countershaft. It can also be moved by the usual hand wheel. The feed of the table is directly operated through gearing from the main driving cone, giving a range of feed through eight changes from 3-64 to 3-8 inches. These changes of feed can be made instantly, by means of a lever, without stopping the machine.

The feed of the table is directly operated through gearing from the main driving cone, giving a range of feed through eight changes from 3-64 to 3-8 inches. These changes of feed can be made instantly, by means of a lever, without stopping the machine.

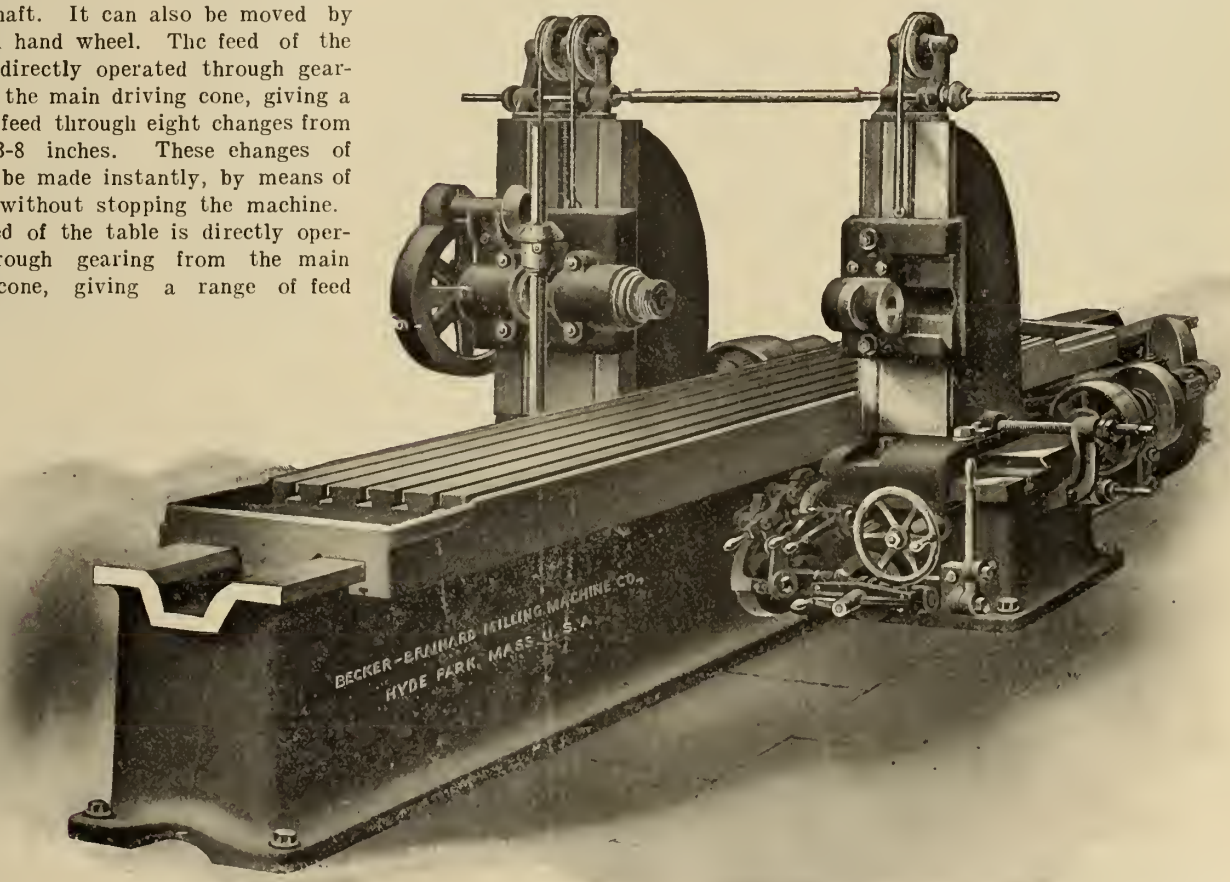
The head may be adjusted from either side of the machine, so that it is not necessary to take the cutters off the arbor in order to change their position in relation to the work.

New Style of Forge.

The bed is extra deep, extending to the floor and making a solid foundation. It is securely braced by heavy cross girders which are evenly spaced throughout the entire length. The bed can be made any length desired.

NEW STYLE OF FORGE.

THE accompanying illustration is of a barrel forge placed on the market by W. H. C. Mussen & Co., Montreal, and as may be seen is a very neat and compact forge. It is designed to take the place of the ordinary three and four leg rivet forges. The blower and its supports are placed inside the barrel, which gives this machine great stability, which is a feature of no mean advantage when it is considered that these forges are used chiefly for structural steel work and must be balanced usually on a beam. With the old type of forge it is a frequent occurrence for the machine to upset, breaking the blower and calling for an expenditure practically equal to the cost of a new forge, as the blower is the most expensive part. Moreover, with the old type unless the blower is taken off every night and placed in the tool box it may readily be stolen, for it is a simple matter to detach the old type of blower from the frame. With this forge, however, the blower is securely fastened inside, protected from thieves and from the weather, and placed where it cannot possibly become damaged. The top is so formed that it may be closed down at night, thus forming a



Planer Type Milling Machine—Becker-Brainerd Milling Machine Company.

tool box, which is provided with a padlock as shown in the illustration.

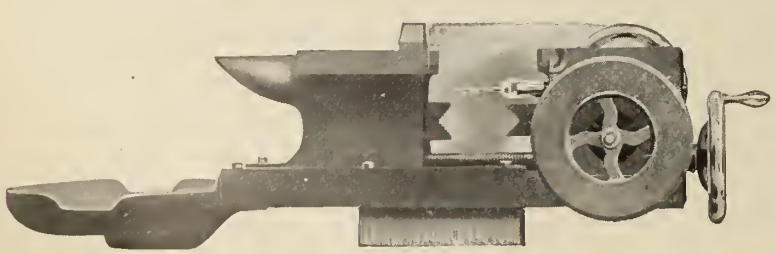
NEW STYLE OF DRILL CHUCK.

A NEW style of drill chuck has recently been placed on the market by the Wide Range Drill Chuck & Tool Co., Muncie, Ind., known as the "wide range drill chuck." The company have been experimenting for some time past to perfect this drill chuck, and the following good points are claimed for it: Strength and durability; smallness of size for its range

New Wide Range Drill Chuck.

of duty; ease of operation; it will take the shank of any kind of drill, whether new or old; being absolutely positive it has no wearing parts; it is self-centreing and always true; it is made with no small or complicated parts; the smallest or largest drill can be placed in the chuck by the pressure of the thumb and finger so that it will never slip.

The accompanying illustration shows a view of this drill chuck.



Detroit Combination Tool.

THE DETROIT COMBINATION TOOL

THE Detroit combination tool is a general utility tool combining a drill, a vice, a pipe vice, an emery wheel, an anvil, a forge and blower for the forge, recently placed on the market by the Detroit Tool Co., Detroit, Mich. The tool is the outcome of an attempt to combine in one tool all the necessary equipment of a repair shop.

The tool consists of a steel-faced bed or base, having at one end a stationary head stock, at the other a movable tail stock and an overhung forge pan. The head stock contains the mechanism of the rotary blower, drill, grinder and the stationary part of the vise and pipe vise jaw. The tail stock serves as an anvil, a support for work being drilled and the movable member of the ordinary and pipe clamping vises. This part slides on the bed between two adjustable guides and is operated through a screw by the hand wheel at the outer end of the head stock. The air delivered by the blower in the head stock is conveyed through a channel in the base to the forge at the opposite end. The fan shaft of the blower projects through the air intake at the front side of the gear case and is fitted to receive an emery wheel, the intake being so located as to form a current of air drawing the emery dust into the forge and away from the operator. The blower and emery wheel are operated by a crank wheel located on the rear side of the gear case. The drill is operated by the same driving wheel, being fitted with a clutch arrangement so that it may be thrown in and out of gear at the will of the operator.

GROOVED SHANK CHUCK.

THE accompanying illustrations are of a style of chuck made to hold twist drills, reamers, etc., which are grooved at the shank with parallel grooves to a uniform depth and angle, the jaws of the chuck corresponding to the shape and size of the grooves. This chuck is designed to prevent all possible turning or drawing out of the tool, and to make it possible to hold with one chuck, a complete range of sizes of drills or reamers and to tighten or release them without the use of any outside tools.

This chuck is manufactured by the Detroit Twist Drill Co., and has but recently been introduced into Canada, the Ontario sales agents being Baines & Peckover, Bay street, Toronto. The chuck has already become quite popular in Canada, which is shown by the fact that A. B. Jardine & Co., Hespeler, Ont., and Butterfield & Co., Rock Island, Que., are about to commence making reamers and other tools with grooved shanks to fit this chuck. There has been a small circular issued, which brings out the points

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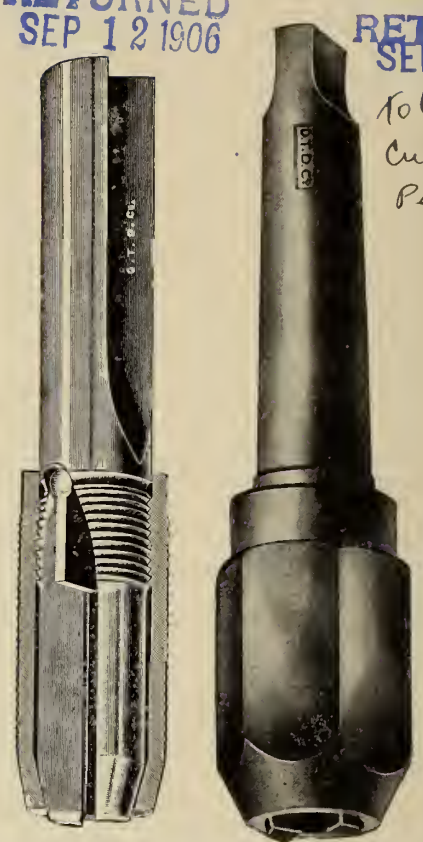


Sectional and Outside View of Grooved Shank Chuck.

of advantage in the chuck strongly, and this circular may be obtained from the sales agents, Baines & Peckover, 124-126 Bay street, Toronto.

STEAM VS. ELECTRICITY.

The conclusion of the committee of five practical steam-railway officials appointed by the American Railway Mechanics' Association to report on electric versus steam railways, after a thorough investigation in Great Britain and elsewhere, is that where there is sufficient diversity of traffic it will pay steam railways to work their suburban and interurban traffic electrically, but in such cases the traffic should have its separate tracks. The statement is somewhat modified by the qualification that "few situations will figure out profitably with the combination service"—that is, the employment of both steam and electricity. As to the relative cost of operation with electricity or steam the committee reports that there is very little accurate information of value.

ABOUT CATALOGUES

By mentioning Canadian Machinery to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

Lighting Industrial Plants. "The Economical Lighting of Industrial Plants" is the name of a very neat little booklet issued by the Cooper Hewitt Lamp Co. It is well illustrated with views of departments in different plants, which are lighted with the Cooper Hewitt lamp.

Nernst Street Lighting. A bulletin issued by the Nernst Lamp Co., sales agents for whom in Canada are the Canadian Westinghouse Co., Hamilton, illustrating and describing the Nernst series alternating vertical glower street lighting system.

Revolving Field Alternators. Canadian Westinghouse Co., Hamilton, June 1906 bulletin illustrating and describing the Westinghouse revolving field alternators. The machines are illustrated and described in detail and illustrations of recent installations are given.

Electricity in Heavy Railway Service. A very handsome bulletin issued by the Canadian Westinghouse Co., Hamilton The bulletin is exceptionally well illustrated with views of cars in service, railways and motors.

The Cone Gas Generator. Catalogue of the Cone Gas Machine Co., Detroit, illustrating and describing the cone gas producer. The catalogue is printed in colors; size, 5 x 8 1-2 inches.

Pittsburg Transformers. Catalogue illustrating and describing the various types of transformers made by the Pittsburg Transformer Co., Pittsburg, Pa. Size, 6 x 9 inches.

Standard Sand Mixer and Screen. A small booklet issued by the Standard Sand & Machine Co., Cleveland, giving a partial list of the users of the Standard sand mixer and screen.

The Burk Machine Co. A set of leaflets issued by the Burk Machinery Co., Cleveland, O., illustrating and describing some of the machines they manufacture.

Ice and Refrigerating Machinery. A 48-page booklet illustrating and describing the various types of horizontal and vertical ammonia compression refrigerating machines and equipment for ice plants, breweries, packing houses, etc., made by the De La Verge Machine Co., foot of E. 138th street, New York. The booklet is exceptionally well illustrated, there being composite views of plants installed in various parts of the world.

Saw Mill Machinery. The Wm. Hamilton Mfg. Co., Peterborough, Ont., are getting out catalogues of their machinery in sections now, instead of in a general catalogue as formerly. These catalogues include "Setting Machines for Saw Mills," "Edgers," "Lath Mill Machinery," "Log Handling Machinery," and "Improved Shingle Mill Machinery." All of these catalogues are very neat in appearance and are well illustrated. Size, 6 x 9 inches.

"Browning" Motors. Leaflet illustrating and describing the "Browning" motors and dynamos manufactured by the Northwestern Mfg. Co., Milwaukee, who are represented by the D'Olier Engineering Co., New York.

Industrias y Productos De Westinghouse. A very handsome catalogue printed in Spanish, describing and illustrating some of the products of the Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Polyphase Induction Motors. June, 1906, bulletin of the Stanley G. I. Electric Mfg. Co., Pittsfield, Mass., illustrating and describing in detail their latest design of polyphase induction motor.

Westinghouse Railway Motor. Circular No. 1035 illustrating and describing the Westinghouse No. 12A railway motor, being a revision of the circular issued in November, 1904.

A.C. and D.C. Motors. Catalogue of Westinghouse alternating and direct current motors for various purposes, issued by the Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Centrifugal Exhaust Heads. Bulletin No. 138, of the B. F. Sturtevant Co., Boston, Mass., descriptive of their centrifugal exhaust heads. The method of separating the water from the steam in these exhaust heads is very interesting.

Flinn Steam Trap. Bulletin No. 137, of the B. F. Sturtevant Co., Boston, Mass., descriptive of the Flinn steam trap. This trap is of the differential type, with water column and diaphram.

Electric Hoists, issued from the general offices of the Wellman-Seaver-Morgan Co., Cleveland, Ohio. This is a booklet of 36-pages, 6 x 9 inches, with a fund of information upon the subject of electric hoists.

Locomotive Cranes. Catalogue of the Wellman-Seaver-Morgan Co., Cleveland, O., on their locomotive cranes, buckets and tubs. The catalogue is well printed and well illustrated. Size 6 x 9 inches.

Single Bolt Cutters. The National Machinery Co., of Tiffin, O., are sending out a bulletin with a full descriptions of their National single bolt cutters. Much technical information on the subject is included.

Iron and Steel Works Equipment. This is a beautifully printed and illustrated book just issued by the Wellman-Seaver-Morgan Company, of Cleveland, Ohio. It deals with open-hearth and reheating furnaces, and contains many fine illustrations of installations which the Wellman-Seaver-Morgan Co. have made in different parts of the United States and Canada.

Miller Gas Engine. General catalogue of the Miller Improved Gas Engine Co., Springfield, O., illustrating and describing the Miller improved gas engine. The catalogue is well illustrated and the engine is described in detail.

Keyseat Milling Machines. Catalogue No. 44 of the Newton Machine Tool Works, Philadelphia, U.S., illustrating and describing the Newton keyseat milling machines. A new style of milling machine for the rapid milling of keyseats for feather keys or short splines is illustrated and described besides the ordinary machines. Size, 6 x 9 inches.

Stone Tools. Catalogue 19 of the Chicago Pneumatic Tool Co., Chicago, illustrating and describing the pneumatic tools used in cutting and carving stone. This is a very complete catalogue, and is well illustrated. Size, 6 x 9 inches, 48 pages.

Pumps, Gasoline Engines. Catalogue E. of the Brandon Pump & Windmill Works, Brandon, Man., illustrating and describing the products of the firm, which include pumps of all kinds, windmills and gasoline engines.

Electric Hoists. General catalogue of Yale & Towne, 9-15 Murray street, New Yorw, illustrating and describing their electric hoists for all classes of work. Size, 6 x 9 inches, 24 pages.

Power and Transmission

Steam Gas Electricity Compressed Air Water

WESTINGHOUSE VARIABLE SPEED MOTORS.

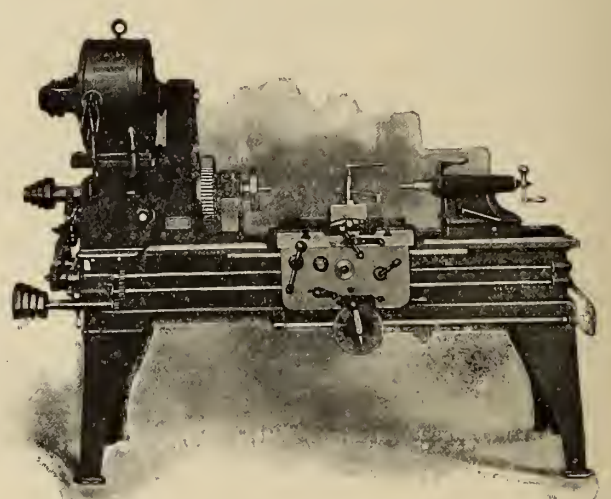
THE rapidly increasing use of individual motor drive on machine tools has led manufacturers of late years to spend considerable energy on the production of a variable speed motor. In individual drive there are several methods of obtaining speed change for the machine. Either a constant speed motor or a variable speed motor may be used for individual drive, change of speed in the case of the constant speed motor drive being obtained through a gear box; while speed change is obtained in the variable speed motor in different ways, according to the style of the motor. The speed of a motor is changed by varying the voltage applied to the motor or by varying the flux density. The applied voltage can be varied in two ways, either by switching the motor from a line of one voltage to a line of another voltage, or by changing the resistance in the armature circuit. It is a combination of these two methods that has been most commonly used. That is, a three-wire system of power distribution is used, thus allowing the applied voltage to be changed by means of a controller from 220 to 110, or the other way round, the intermediate speeds being obtained by varying the armature-circuit resistance. The outstanding disadvantage of this method is its inefficiency, because of the increased heat loss caused by the addition of resistance to the armature circuit. The regulation of speed is accomplished most economically by varying the magnetic flux. This is, of course, done by varying the current through the field coils by varying the resistance in the field circuit. The objection to this method in the ordinary motor is that in consequence of the distortion of the magnetic field caused by the changing of the flux density the brushes will tend to spark, and the greater the change the more sparking there will be. This sparking is caused by the brushes not being on the neutral points of the armature, the neutral points naturally changing as the magnetic field is distorted.

The interpole motor was designed to overcome this difficulty. In this style of motor a small pole is placed in between each two ordinary poles, the winding on which is in series with the armature winding. The polarity and strength of these poles is such that their action counteracts the effect of armature reaction upon the magnetic field when the resistance in the field circuit is changed. Thus, with these motors, a large speed variation can be obtained by means of field control without undue sparking at the brushes.

The type S. A. motor of the Canadian Westinghouse Co., Hamilton, is of this style. These motors are the same in design and construction as the Westinghouse type S motor, except for the addition of the auxiliary or interpoles. These poles are bolted to the frame midway between adjacent main poles. The coils are machine wound and are insulated in the usual way before being placed upon the poles; they are held in place by the auxiliary poles and the projecting tips of the main poles. The auxiliary poles and coils can be removed without in any way disturbing the main winding, by disconnecting the coil connections, withdrawing the bolts which hold the poles to the frame and sliding the poles and coils out in a direction parallel to the armature shaft.

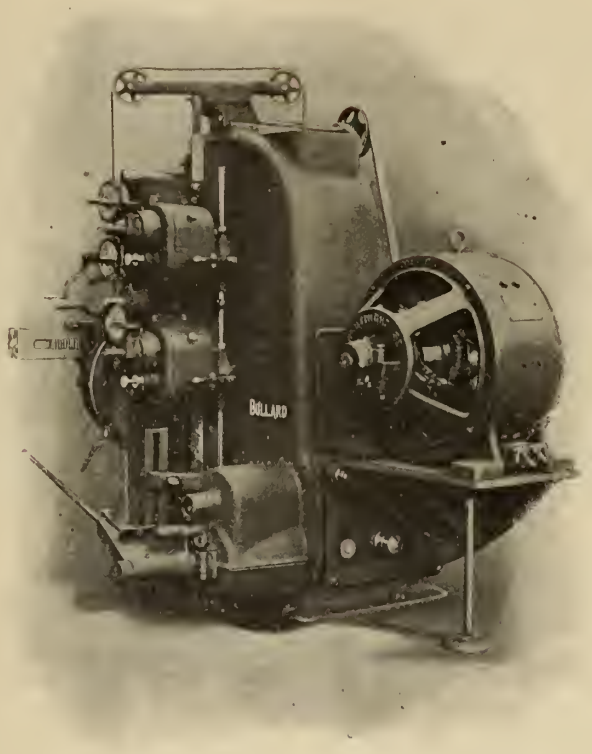
Since the winding of the auxiliary poles is in series with that of the armature, their magnetising effect will be proportional to the armature current. The arrangement of the poles is such as to apply the corrective influence of the auxiliary windings at the points where the distorting effect of the armature current is greatest, and this influence is directly opposed to that produced by the armature current. Thus the resultant field is made up of three components: that due to the shunt winding and proportional to its ampere turns; that due to armature reaction and proportional to the ampere turns of the armature winding, and that due to the auxiliary poles and proportional to the turns of the auxiliary coils. The field distortion produced by the armature reaction as the resistance in the shunt field current is changed is counteracted by the action of the auxiliary coils, and thus the resultant position of the magnetic field is maintained as formed by

Westinghouse Type S. A. Motor.



Lathe Equipped with Type S. A. Motor Showing Method of Remote Control.

the full field, no matter what the speed of the motor is within its limits, and consequently the motor will operate at full load at any speed within its range; and the auxiliary series windings give such control over commutation that the motor will carry momentarily fairly heavy overloads without serious sparking.



Vertical Turret Lathe Equipped with Type S. A. Motor.

The fields of the S A type of motor are made of cast iron yokes, with four inwardly projecting poles of laminated steel bolted to the frame. The field coils are machine formed and are interchangeable. The armature is of the slotted drum type, with laminated cores and machine-wound coils. The bearings are babbitt-lined and self-oiling. The controllers used for this type of motor are the drum type, the Westinghouse railway controller.

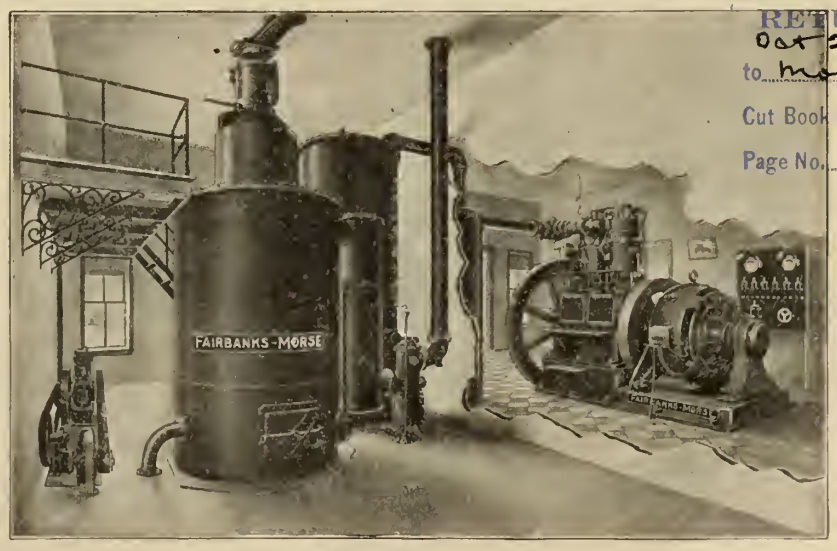
FAIRBANKS-MORSE GAS PRODUCING PLANT.

THE accompanying illustration gives a good idea of the appearance of the Fairbanks-Morse suction gas plant, representing the Fairbanks-Morse vertical producer gas engine direct connected to a Fairbanks-Morse dynamo. The Canadian Fairbanks Co., Limited, of Montreal, are installing a plant similar to this one in a large manufacturing establishment in Montreal. The producer itself will be of 100 h.p. capacity and will feed two 43 h.p. vertical producer gas engines, which will be directly connected to 30 k.w. generators. These in turn will operate motor-driven machines throughout this establishment and also furnish light for the plant. This represents a very neat layout lor a power plant, as will be seen by the description. There is a wall dividing the producer room from the engine room proper, and the coal is fed from an overhead hopper. An overhead gallery is easily reached by a stairway, and gives the operator in charge access to the top of the producer for the purpose of feeding in coal and poking the fire. Directly to the left of the producer is shown a Fairbanks-Morse 2 h.p. gasoline engine which is belted to an air pump and blower. This does away with the necessity of a hand blower for blowing the fires in the producer, and the air pump is used to fill an air tank, enabling the operator to start the engine by compressed air. In many cases these 2 h.p. gasoline engines are also used to operate a small elevator for carrying the coal to an overhead bin, and owing to the small quantity of coal consumed it is only necessary to operate this engine and elevator at long intervals.

The rapidly increasing cost of the various kinds of fuel, and the ever-present necessity for reduced cost of production have lead to the investigation of means for securing power upon a more economical basis than even the most modern steam plant or most highly efficient gasoline engine. The development of a satisfactory gas engine having been effected, a simple, inexpensive and reliable source of gas was sought for, and this has resulted in the use of producer gas plants of the "suction" type and "pressure" type.

Each type of producer has its advantages and limitations, but the suction type of producer is the more popular for supplying gas engines.

A suction producer is practically limited as to fuel to the use of either anthracite, charcoal or coke, because bituminous coal and all low grade fuels contain by-products which must be eliminated from the gas by mechanical processes; but the limitation of the suction producer as to the kind of fuel is offset by the advantages which that plant enjoys in comparison with the pressure producer. The advantages claimed for the suction producer over a pressure producer are



Fairbanks-Morse Gas Producer Plant.

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briefly: Smaller cost of installation and less space occupied; higher efficiency because of the smaller amount of power consumed in bringing the gas from the producer through the cleaning processes to the engine; there being no steam under pressure, there is no danger from explosions; there is not the difficulty of regulating the supply; there is no danger of gas leakage because the gas is under less than atmospheric pressure nearly all the time.

The Fairbanks-Morse suction gas producer consists of the producer, the vaporizer, the scrubber and the gas receiver. The vaporizer is situated around the upper part of the producer, the steam being brought down to the base of the producer, and there mixed with the air before being drawn up through the bed of incandescent fuel. From the producer the gas passes through the trap or seal up through the scrubber. The scrubber contains coak which is sprayed from above.

The upright gas engine shown in the illustration of the installation is a four-cycle engine. The engine is governed by a special governor controlling the proportions of the fuel mixtures. The engine is of the enclosed, dust-proof type, but all parts are readily accessible. The frame is split transversely to facilitate handling, aligning and repairing. The main bearings are carried in the frame, and all bearings are adjustible for wear and alignment. The trunk pistons are of universal length and are provided with a special lubricating device. The pistons are accurately centred to equalize the wear on the cylinders. The valves and igniters are operated by single cam shafts. The engine is provided with an improved oiling system with graduated sight feed for each principal bearing, the oil being removed and filtered for re-use. The engine is started by compressed air. There is a carefully conducted shop test for load, regulation and efficiency before the engine leaves the factory.

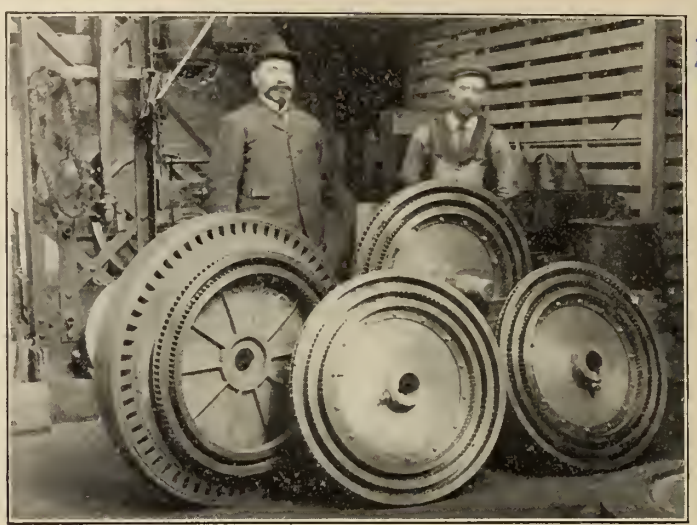


Fig. 1.—New Rotary Engine.

NEW ROTARY ENGINE.

STILL another rotary engine is being developed. A Montreal engineer, V. Filteau, has invented and patented a rotary engine, which has some new and interesting features. The inventor calls it a compound turbine engine. Figure 1 gives an outside view of the engine, and figure 2 is a sectional view.

The engine consists of a series of chambers, each chamber containing a piston device and means for connecting this device to the shaft, and the steam being supplied from one chamber to another through ports which increase in size or number as the steam progresses from one chamber to the next. The piston device consists of a disk (a) having a number of vanes or buckets (b) carried upon the periphery of the side next the exhaust end of the engine. Each of the piston wheels is keyed to the shaft. Any number of chambers may be used according to requirements, but the inventor says that an engine with twelve chambers appears to be the most satisfactory. The ports for the communication of steam are cut through the walls in the annular space between the vanes and the circumferential walls as shown at (c). These ports are placed at different points around the annular space, and as their number or size increases with each chamber towards the exhaust end of the engine, the steam will be admitted in greater volume to each successive chamber. Each of these ports is provided with a nozzle as shown in the sketch, which directs a jet of steam upon the buckets opposite each nozzle. The series of baffle plates (d) are to prevent the steam, after once having impinged upon the buckets, from again doing so from

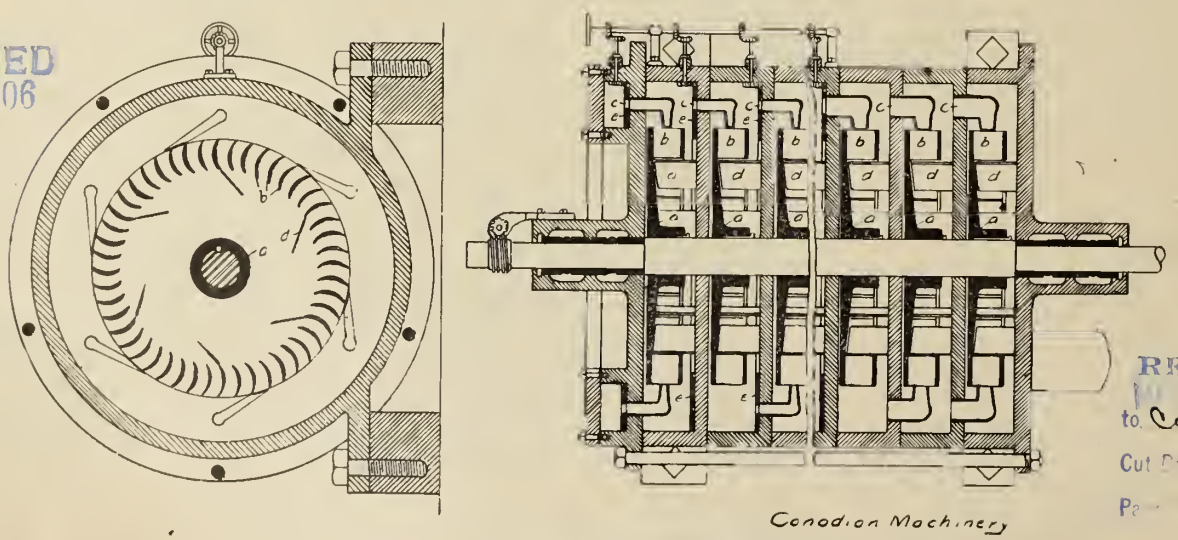


Fig. 2.—Sectional View New Rotary Engine.

the interior of the wheels. The exhaust port is situated in the last chamber of the series.

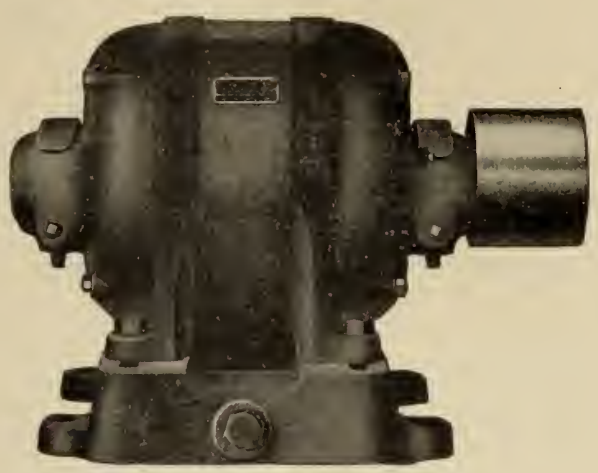
The engine is controlled by regulating the amount of port opening between the chambers, this being done by means of annular valve plates shown at (e), these plates being rotatively mounted upon the sides of the walls so as to be operated by the set of gears and rods as shown. The engine is governed by an automatic governor, which operates to close completely some of the ports, through the means before described, thus cutting off some of the steam jets and cutting down the power. This method of completely closing some of the ports instead of partially closing them all is adopted because in that way the efficiency of the engine is better maintained under varying load.

The radical difference between this turbine and well known types is in the compounding of cylinders. In the well known types of turbines the expansive qualities of the steam are utilized by compounding the cylinders, each successive cylinder being of greater capacity than the preceding one; whereas in this turbine each successive cylinder is the same size, the steam expanding through the increasing port opening area with each successive chamber.

STANLEY G. I. INDUCTION MOTORS

THE accompanying illustrations show an assembled view and a disassembled view of a new type of induction motor recently placed on the market by the Stanley G. I. Electric & Mfg. Co., Pittsfield, Mass. The distinctive feature of this type of induction motor is the dispensing with the cast iron frame which, in ordinary induction motors, completely surrounds the active part of the motor, consisting of laminated iron core and windings.

The method of supporting the active material in this type of motor is by means of end frames so arranged that the laminations are freely exposed to the air, thus allowing the heat to radiate with great dispatch. In the larger sizes the laminations are built up in sections, and for that reason the end frames are reinforced across the outer surface of the core by ribs to which the punchings are attached. But the smaller sizes are built up as shown in the assembled view of the motor. Here the



The Stanley G. I. Induction Motor.

end frames and the laminations are held together by means of a riveted construction, which leaves the laminated iron core freely exposed to the air around its entire periphery. This constitutes a rigid design.

In other respects there is nothing out of the ordinary in the construction of motor. The field windings consist of four wound coils, attention being paid to their proportioning so that when they are put in place there will be no undue strain upon the insulation. The field windings, after being placed in the slots, are thoroughly saturated with insulating compound, making them moisture proof and solidifying and unifying the windings, thus preventing injury to the insulation of individual wires in the windings.

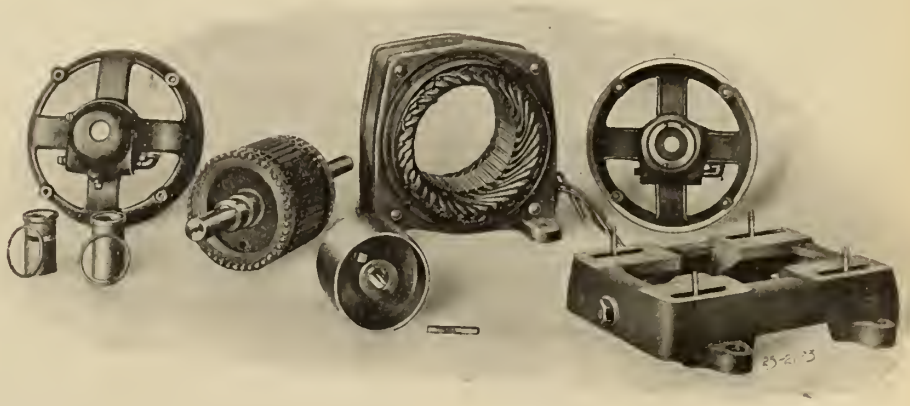
The end shields carrying the motor bearings are bolted to the end frames, which can be arranged to allow the motor to run on the floor, wall, or ceiling. They are also shaped so as to protect the ends of the coils. The bearings are self-aligning and are lubricated by the ring-oil method.

The rotor is of the usual squirrel cage type. The laminations are mounted directly on the shaft and held in position by a simple device. The conductor bars are placed in slots and are short-circuited with end rings, which rings are made up of several thin disks to facilitate the radiation of heat.

The chief advantages claimed for this style of design are improved ventilation and the curtailment of inactive material, thus securing smaller dimensions and lighter weight for a machine of the same power.

I. H. CO. MAKING GAS ENGINES.

The International Harvester Co., 7 F.F. Monroe street, Chicago, has but recently taken up the manufacture of gas and gasoline engines, and the reputation which the firm has acquired for its other lines of manufactures should be a warrant for the quality of the engine they are turning out. This company make a specialty of engines in the smaller sizes, and in these sizes the many good points of a gasoline engine will recommend them to the small power user. Some of these good points are: The readiness with which they may be started and stopped; they can furnish power at a moment's notice, and as soon as power is not required the engine can be shut down and all expense ceases.



Parts of Stanley G. I. Induction Motor.

The I.H.C. engines are adapted to use alcohol as fuel as well as gas and gasoline. The engines are made in various sizes in portable and stationary, horizontals and in verticals, thus adapting them for all classes of work.

The company are publishing an interesting booklet on the power question, which may be obtained from the International Harvester Co., 7 F.F. Monroe street, Chicago.

CORRESPONDENCE COLUMN

Canadian Patents.

Editor Canadian Machinery :—I would like to know what it would cost to take out a patent in Canada. I have a molding machine which I am getting covered here by patents, and wish to have it covered in Canada also. I wish you could get me some information concerning this.

JAS. F. WEBB.

Elkhart, Indiana.

(A simple invention can be patented in Canada for $45, the patent rights lasting six years. This $45 includes Government fees and patent attorney's fees. The inventor has only to supply the attorney with sketches or photographs of the invention and a description of it sufficiently explicit and in detail to allow the attorney to cover by the claims all points which the inventor wishes protected. By a simple invention is meant one which does not require very elaborate drawings to explain. In case the invention is very complicated, an additional fee may be charged by the attorney for the extra drafting involved. At the expiration of the first six years the government require another fee of $20 to protect the invention for a further period of six years.—Editor.)

* * *

Gas and Gasoline Engine Rating.

Editor Canadian Machinery :—We notice that there is some controversy in reference to the rating of gas and gasoline engines. We wish to say that in our plant at Galt we test all engines with a prony-brake and each engine is compelled to pull 20 per cent. more than its rating. We believe in giving more power than we claim we will, and therefore each and every engine that we ship out we guarantee will run successfully ten hours a day at 15 per cent. more than their rating. We are pleased to know that this subject has come up, and think that it will be good policy for the gas engine manufacturers in Canada to get together and agree to rate in no other way excepting by brake horse-power.

THE CANADIAN McVICKER ENGINE CO., LTD.,
J. R. GOLDEN,
General manager and secretary.
Galt, Ont.

* * *

Iron Pyrites Mine in Hastings.

Editor Canadian Machinery : — Referring to your June issue, I am interested, as an expert in sulphite pulp making, to know where I can find the office or owners of the iron pyrites mine in Hastings County, from which ore there is made in Buffalo sulphuric acid. Where is the shipping place, and where is Hastings County ? I am a subscriber of Canadian Machinery and am willing to pay for postage expenses you may incur in getting the information. Kindly do your best for me in this matter.

"POSTOFFICE."

Ottawa, Ont.

(The owner of the iron pyrites mine in Hastings County referred to is the British America Development Co., Mail building, Toronto. All the ore is shipped by this company to the Contact Process Co., Buffalo, N.Y., who make the sulphuric acid. Hastings County is a county in Ontario situated on eastern extremity of Lake Ontario. Further information may be obtained from Mr. Cheesworth, manager of the British America Development Co.—Editor.)

* * *

Third Class Engineer Qualifications.

Editor Canadian Machinery :—Being a reader of your popular magazine, I would like to ask for some information as regards the qualifications of an engineer. I am a mechanic, age 22, well up in engine work, and have the theory of the management of boilers and power transmission machinery. What would be the best course for me to follow to obtain a third class certificate for engineer ? Any information you can supply concerning this will be appreciated.

W. A. WEEKS.

50 Richmond street, Montreal.

(By application to the chief engineer of the Board of Trade building, Montreal, may be obtained any information regarding the qualifications for an engineer. In the Ontario association the examination for the third class engineer's certificate is not at all severe, and in fact any person having had ordinary experience in engine running should very well answer all questions asked. A printed paper is submitted to the candidate, the questions on which must be answered in

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PROVING HIS TITLE.

Lady (in party viewing boiler shop)—And which is the foreman ?

Casy (proudly)—Oi am.

Lady—Really ?

Casy—Oi can prove it. (Calls to helper.) "Kelly, Kelly, yer foired."—Ryerson's Monthly.

* * *

"Here's your money, dolt. Now, tell me why your rascally master wrote me eighteen letters about that contemptible sum ?" "I'm sure I can't tell, but if you'll excuse me sir, I guess it was because seventeen did not fetch it."

THE MAN WHO SELLS.

WHAT means this prosperity? Sales. Sales necessitate transportation, which calls for power and vehicles. The results are felt in every part of the country. Sales light the furnace fires, blacken the sky with smoke, set machinery in motion, quicken the demands for labor, and spread the smile of plenty over the face of the land.

He who sells things is the apostle of happiness ; he is the bulwark of prosperity ; he fills the hotels ; he crowds the trains and he loads the freight cars with goods. The man who sells things is the best friend of everybody. He makes the people believe they need it; he is patient, tactful, broad-gauged, generous, good natured and tireless ; for him no whistle blows to sound the end of his daily toil ; for him there are but few peaceful evenings at his home fireside ; for him it is hustle, hustle, hustle ; he travels up and down the highways ; he seeks audience with and tells his tale to men of varying titles ; he runs the gauntlet of every conceivable degree of importance from the president to the office boy.

All honor to the man who sells things. Let us call him the commercial engineer. When he is not abroad in the land there is "nothing doing." His appearance foretells commercial activity, and just in proportion as he succeeds, the tide of prosperity ebbs and flows. The man who brusquely turns him down, or who affects to be bored by his presence, or who bars him from his office, does an injustice to the interests confided to his care, and also robs himself of a large amount of information that he needs in his business.—Geo. A. Post in "Graphite."

CONSOLIDATION OF FIRMS.

The Link Belt Machinery Co., Chicago, the Ewert Mfg. Co., Indianapolis, and the Link Belt Engineering Co., Philadelphia, have been consolidated into one company, to be known as the Link Belt Co., with headquarters at Chicago. The officers of the new company are : President, Charles Piez ; first vice-president, G. G. Howe; second vice-president, S. B. Beck; treasurer, S. Howard-Smith; secretary, Dyke Williams. The three plants will continue to be operated. The Chicago firm was organized in 1880, and two years later opened a branch in New York. The firm of Burr & Dodge, the Philadelphia representatives, were succeeded in 1888 by the Link Belt Engineering Co., and a new plant started at Mietown, four miles from Philadelphia. The Ewart Co. have been the manufacturers of the original link belting while the two link belt companies have operated along the same lines in the manufacture of conveying machinery.

ENGINEERING NEWS
AND SOCIETY NOTES

SOCIETY OFFICERS.

Canadian Mining Institute.

President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer Lamb, Victoria, B.C.; treasurer; J. Stevenson Brown, Montreal.

Toronto Branch A. I. E. E.

Chairman, R. G. Black; vice-chairman, K. L. Aitken, secretary, R. T. McKeen.

Marine Engineers.

Grand president, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N.B.

Canadian Electrical Association.

President, R. G. Black, Toronto; vice-presidents, R. S. Kelch, Montreal, W. R. Ryerson, Niagara Falls, Ont.; secretary-treasurer, T. S. Young, Confederation Life Building, Toronto.

Canadian Association of Stationary Engineers.

President, Joseph Ironsides, Hamilton; vice-president, Ed. Grandbois, Chatham; secretary, W. L. Outhwaite, Toronto.

Ontario Association of Stationary Engineers.

President, A. M. Wickens, Toronto; vice-president, W. A. Sweet; board of directors, W. Blackgrove, W. A. Sweet, A. M. Wickens and A. E. Edkins; treasurer and registrar to be appointed by board of directors.

Canadian Railway Club.

President, S. King; secretary, James Powell, chief draughtsman motive power department, G. T. R.; treasurer, S. S. Underwood, chief draughtsman car department, G. T. R.

Engineers' Club of Toronto.

President, F. L. Sommerville; treasurer, W. J. Bowers; secretary, Willis Chipman, Rooms 96 King St. W.

Canadian Society of Civil Engineers.

President, H. D. Lumsden, Ottawa; vice-presidents, M. J. Butler, Ottawa; C. B. Smith, Toronto; W. M. Walbank, Montreal; secretary-treasurer, C. H. McLeod. Rooms, 877 Dorchester street, Montreal.

Society of Chemical Industry

Chairman, Prof. W. H. Ellis; vice-chairmen, H. H. Van Der Linde, Milton; H. Hersey, A. McGill; hon.-secy., Alfred Burton, 44 York Street, Toronto.

Ontario Land Surveyors.

President, Otto J. Klotz, Ottawa; vice-pres., Thos. Fawcett, Niagara Falls; secy.-treas., Capt. Killaly Gamble, Toronto.

Engineers' Society, S.P.S., Toronto University.

President, K. A. McKenzie; vice-pres., B. J. McGugan, rec. secy., A. M. Damn; treas., G. E. Quance; cor. secy., A. E. Jupp.

CONVENTION OF C. A. S. E.

THE annual convention of the Canadian Association of Stationary Engineers was held in Galt on August 7, 8 and 9. Mayor Thomas, of Galt, opened the convention by an address of welcome to the delegates, to which A. M. Wickens, Toronto, made response. The morning and afternoon sessions of the first day were taken up by the president's address, the secretary's and treasurer's reports, and a discussion as to past presidents' privileges to act upon certain committees. During the afternoon and evening the delegates were entertained by a trip over the Galt, Preston and Hespeler Railroad to Hespeler, Preston and Berlin, and upon their return by a complimentary concert given by the Galt Kilties.

The paper on "The Engineer and his Boiler," read before the association on the second morning by A. M. Wickens, Toronto, was of considerable interest. The matter of the past presidents was again brought up, and after some lively discussion and the defeat of an amendment this resolution was passed, i.e., "that only immediate past presidents be entitled to a vote and the privileges of the association. In the afternoon a visit was paid to the large plant of the Goldie & McCulloch Co.; and in the evening a banquet was held at the Imperial Hotel.

The last day's session, as is usually the case, was a busy one, considerable new business being transacted as well as the election of officers. A committee was appointed to look after the organization of an official organ in the form of a monthly magazine which will be devoted to the work of the association.

The election of officers resulted as follows: president, Joseph Ironsides, Hamilton; vice-president, E. Grandbois, Chatham; secretary, W. L. Outhwaite, Toronto.

The convention will be held in Guelph next year.

CIVIL ENGINEERS' EXCURSION.

AN excursion on a somewhat large scale has been proposed by the Canadian Society of Civil Engineers, and will be carried into effect starting Saturday, Sept. 8, at 9.00 a.m. The Canadian Pacific Railway has placed a special train at the disposal of the society and it is expected that about 150 members will take part.

Going west it is proposed to visit Winnipeg, Calgary, Banff, Field, and Glacier, and to reach Vancouver about Sunday, 16th September. Such stay will be made at these places as will enable the party to carry out the various local programmes. If it is found to be practicable a special excursion to Victoria and Nanaimo will be arranged. Returning, the party will leave Vancouver on Wednesday, the 19th, go down the Arrow Lakes, and visit points of interest in the boundary country and the Crow's Nest district. The train will be sent around to meet the party at Kootenay Landing. On the return journey, the only important stop will be at Fort William, where the terminal facilities of the Canadian Pacific Railway will be inspected. The train will reach Montreal on Thursday evening or Friday morning, 28th of September.

The cars will be available for the use of the members during the entire excursion, except for the trip down the Arrow Lakes and the visit to the boundary district. In the interval between the completion of the lake trip and rejoining the train at Kootenay Landing, ordinary first-class coaches will be used, and the party will stop over night at hotels at Rossland, Grand Forks, and Nelson. The ordinary rates will be charged on Lake steamers and the hotel accommodation will be an extra charge.

ENGINEERS MEET AT CARDIFF.

THE British Institution of Mechanical Engineers held their convention at Cardiff, Wales, from July 30 to Aug. 3, 1906. Some of the American engineers who had attended the meeting of the Iron and Steel Institute in London were present at the convention. A number of interesting papers were read and discussed, among them being: "Blast Furnace Blowing Engines," "Some Notes on the Equipment of Collieries," "Manufacture of Tin Blasts," "Railway Motor Power Traffic."

ELECTRICAL UNITS AND STANDARDS.

The Imperial Government has called an international commission to meet in London in October to consider the subject of electrical units and standards. The Canadian Government has been asked to appoint a representative and Mr. Ormond Higman, chief of the Electrical Standard's Laboratory of the Inland Revenue Department, has been chosen.

NEW TREATMENT OF IRON ORE.

A new process of treating iron ore in the production of malleable iron and steel has been invented and tested in Australia. This process, the Heskett-Moore, is a continuous process, and it is claimed that a saving of 25 per cent. is effected in the manufacture of iron and steel by this process. It is also claimed that a smelting plant arranged for this process would cost less than one-fourth that of ordinary smelting plants. Patent rights for this process have been applied for throughout the world. The Department of Trade and Commerce, Ottawa, have a number of copies of a detailed description of this process, which will be available to those interested in the investigation of this process.

PERSONAL MENTION

Commissioner of Industries and Publicity.

A Department of Industries and Publicity has been established by the civic authorities of the City of Toronto. The council has finally recognized the importance of having the city advertised as an industrial centre, and of having a department at the City Hall which will be a general information bureau for manufacturers already established in the city and for manufacturers who are looking for sites. Mr. Jos. E. Thompson has been appointed Commissioner of Industries and Publicity, and the policy of the department has been left largely to his discretion. At present everything in connection with the department is in its primitive stages, and Mr. Thompson is in a receptive mood for information or

MR. JOS. E. THOMPSON,
Commissioner of Industries and Publicity, Toronto

suggestions which will be of use to him in the organization of his department and in the laying down of a definite policy to be followed in the conducting of the affairs of the department. Mr. Thompson has, however, formed a general policy, the details of which will have to be worked out gradually as conditions and circumstances suggest. This policy might be outlined thus: To advertise Toronto so as to bring before manufacturers and prospective manufacturers the natural and artificial features of the city which go to make it a good manufacturing centre; to interest as many manufacturers looking for sites as possible, but not to induce a manufacturer to leave the municipality he is located in to come to Toronto by offering special concessions; to form a bureau to which manufacturers in the city may take their grievances and requests, and from which these grievances and requests will be started through the proper channels in the civic government.

Mr. Thompson has been in the civic employ for some time in the city treasurer's department, and while in that department has won for himself many friends around the City Hall and throughout the city. Mr. Thompson has the hearty and genial manner which makes him a pleasant man to meet, and has the capacity of holding one's best attention even in ordinary conversation, and these qualities argue well for his making a qualified success of the new department. There is a decided need for such a department, and with a capable man at the head of it, the city should find it a paying investment. However, it is a department in which there will be a lot of work done of which the general public will never hear, and from which there may be no apparent results, and for that reason the commissioner of the department cannot reckon too much upon public apprcciation of his efforts, but must be satisfied, at least during the initial stages of the building of the department, with a personal realization of well-spent energies in the best interests of manufacturers and the city. Mr. Thompson deserves the support of the manufacturers and all others interested, and will appreciate greatly any interest taken in his department in the way of useful suggestions and letters of encouragement and support.

* * *

Death of Louis Cassier.

Among the victims of the appalling railway disaster on the London & Southwestern Railway near Salisbury, Eng., was Louis Cassier, founder of Cassier's Magazine, New York. Mr. Cassier was on one of his many trips from New York to London, and was one of those to leave the steamship New York to take the fast night express from Plymouth to London. As is known, the train left the track at Salisbury, resulting in the death of twenty-three passengers and the injury of many others. Besides founding and developing Cassier's Magazine, now so well known on this continent and in England, Mr. Cassier purchased the Electrical Age, the enterprise with which he inspired it accounting for the standing it now holds among electrical periodicals.

* * *

The Montreal office of Canadian Machinery was recently favored with a visit from Mr. Thos. Nopper, representing Canada machinery agency, who while there renewed a school boy acquaintanceship of thirty years ago. Mr. Nopper is a native of Western Ontario and a thoroughly practical man. He entered the selling end of the machinery business some time ago and has met with no small success.

* * *

New General Manager.

With the rapid industrial growth of Canada the younger men are coming more and more to the front, and assuming positions of responsibility formerly held only by those more advanced in years. This was demonstrated by the recent appointment of Mr. R. J. White to the general managership of the Frost & Wood Co., Ltd., Smith's Falls, Ont. Mr. White who has for some time past been assistant general manager, has been with the Frost & Wood Co. for the past sixteen years, during which time, by his

RETURNED
SEP 19 1908

R. J. WHITE,
General Manager Frost & Wood Co.

energy and executive ability, he has risen from post to post. In his present position he directs the affairs of one of the largest industrial concerns in Canada, and in this capacity has the best wishes of a large number of friends throughout the Dominion.

* * *

A Change all Around.

By a somewhat unusual coincidence three brothers, graduates in Science of McGill University, were appointed to new and much better positions during the course of a week. They are Messrs. A. A., G. Percy and L. Heber Cole, of Montreal, all being honor graduates from their alma mater.

Mr. A. A. Cole, for some years mining engineer and assayist of the War

Eagle and Centre Star mines, Rossland, B.C., has been appointed expert mining engineer to the Temiscaming and Northern Ontario Railway Commission, where his duties commenced on August 1st. This appointment is a recognition of Mr. Cole's high position in his profession. Mr. G. Percy Cole, who went to the United States to get the best experience obtainable in the electrical engineering field, and who has been assistant engineer to the Wagner Electric Mfg. Co. of St. Louis, is coming back to Canada, having engaged with Allis-Chalmers-Bullock, of Montreal, where he will act as assistant electrical engineer. After graduating last spring Mr. L. Heber Cole took up work at Victoria Mines, Ont., but recently was asked to go to Phoenix, B.C., where a position awaited him that would be welcomed by many graduates with several years' experience.

* * *

Mrs. Francis A. W. McIntosh, formerly advertising manager of the Standard Tool Company, Cleveland, O., and more recently connected with the advertising department of "Power," New York, now has charge of the publicity department of the Norton Company, Worcester, Mass., the appointment taking effect August 1.

Chas. H. Mitchell, C.E., Niagara Falls, Ont., late chief assistant engineer of the Ontario Power Co., has returned from an eight months tour through Europe, where he has been studying the many phases of hydro-electric power development in Central Europe. The absence of coal in Central European countries, especially Switzerland, and the many natural water powers, has occasioned the rapid advancement of hydro-electric power development. An idea of the cost of electro power in these countries can be obtained from the fact that in some localities where steam coal sells from $5 to $7 per ton, electric power can be obtained within 25 miles of the generating station in 500 horse power blocks of 24-hour power for from $25 to $35 per horse power per year.

A complimentary dinner was tendered Mr. Eugene Kibeler, at the Country Club, Dixie, Montreal, July 28, by the heads of the mechanical departments of Allis-Chalmers-Bullock, Limited, on the occasion of his leaving the employ of the company. Mr. Kibeler was formerly foreman of the machine shop, but left to accept a position in the west Allis shops of the Allis-Chalmers Co. in Milwaukee. After the dinner he was presented with a diamond pin and a purse of gold.

Cecil B. Smith has been engaged to superintend the construction of the Winnipeg civic power plant at a salary of $10,000 for two and a half years. He will be allowed to act as consulting engineer of the Ontario Power Commission for a period not exceeding three weeks each year.

Mr. R. I. Henderson, formerly secretary of the Henderson Roller Bearing Co., which was recently reorganized and an entirely new management appointed, is under arrest in Walkerton, Ont., in connection with charges of dishonest treatment by him of some of the original stock subscribers.

The firm of McLean & Sophus, who have been doing business as mechanical engineers and machinery experts at 301 St. James street, Montreal, for a little over a year, have dissolved partnership The St. James street business will be continued by Mr. McLean and associates under the firm name of W. B. McLean & Co. Mr. Sophus retains the agency for Schuchardt & Schutte, of New York, and W. T. Glover & Co., Manchester, England. He has opened an office and showroom at 13 St. John street, where he is already exhibiting a stock of split steel plate pulleys, Gronkoist drill chucks, leather shears, folding rules and high grade tools. A line which Mr. Sophus intends to push in this country is the "Vesta" cream separator, manufactured at the Swedish works of Schuchardt & Schutte.

INDUSTRIAL PROGRESS

MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired.

E. J. Rodd will erect a two-storey machine shop in London.

Gourlay, Winter & Leeming will build a piano factory in Toronto.

The Forwell Foundry Co., of Berlin, will double the capacity of their plant.

Conrad Bros. have established a new planing mill at Lunenburg, N.S.

Randall & Greenshaw are going to erect a grist mill at Shoal Lake, Man.

The York & Sunbury Milling Co. are to erect a $20,000 saw mill at Gibson, N.B.

The Arcola Wood-working Co., of Arcola, Sask., are building a sash and door factory.

The Sisters of St. Joseph will build an infants' home in Toronto to cost $46,000.

E. C. Horn, of New York, has the contract for a $70,000 vaudeville theatre in Ottawa.

The Calgary Cement Co's plant has been destroyed by fire. The loss will be $100,000.

The Peterboro Steel Rolling Mills Co. have been looking for a site for a plant at Peterboro.

The grist mill of McCraken Bros., Tiverton, Ont., has been almost totally destroyed by fire.

The British Columbia Electric Railway Co. will build a branch sub-station at Ladnor, B.C.

The Goderich Lumber Company will rebuild their saw mill, which was destroyed by fire.

The Frontenac Gas Co. have acquired land in Quebec City for the erection of a large gas plant.

The Harmsworth pulp mills at Grand Falls, Newfoundland, were destroyed by fire. Loss $30,000.

J. P. Hall and E. C. Perry, two Americans, will establish a soap factory at Saskatoon, Sask.

A syndicate, headed by John A. Moore, of Seattle, will erect saw mills on Moresby Island, B.C.

The Wade Mfg. Co., Dundas, have commenced the manufacture of gold and silver plated novelties.

The Davis Dry Dock Co. have ordered a duplex pump from the Smart-Turner Machine Co., Hamilton.

The Sherwin-Williams Paint Co. have secured a two-acre site in Winnipeg for the erection of a factory.

The Sudbury Foundry Co. will in a short time be erecting their foundry building in Sudbury, Ont.

The Western Canada Cement & Coal Co. will erect a half million dollar cement plant at Exshaw, Alta.

The contract has been let for the building of the Listowel branch of the Guelph & Goderich Railway.

The Miramichi Lumber Co. are erecting a large new rossing mill at Chatham, to cost about $75,000.

The Quebec Gas Co. have ordered a coke crusher from the Smart-Turner Machine Co., Hamilton, Ont.

The False Creek Lumber Co., of Vancouver, will build a new saw mill near the city at a cost of $15,000.

The Canada Plate Glass Co. will erect a glass bending factory on Ashbridge's Bay land, Toronto.

The St. George Pulp & Paper Co., of St. George, N.B., had their mill destroyed by fire. Loss $25,000.

Battleford, Sask., citizens will vote on a by-law to expend $30,000 for installing a water works system.

Fire has damaged the paint warehouse of Sanderson, Pearcy & Co., Toronto, to the extent of $10,000.

The John Inglis Co., Toronto, have ordered a duplex pump from the Smart Turner Machine Co., Hamilton.

The Peterborough Steel Rolling Mills Co. are considering the claims of Peter-

borough, Port Hope, Cobourg and Lakefield as the site for rolling mills that will be established soon.

The J. B. Gateman Co's button factory was destroyed at Berlin. Loss $8,000 to $10,000, partially insured.

The Locomotive & Machine Co., Montreal have just completed a $1,600 steel pavilion at Lansdowne Park, Ottawa.

The Hamilton Bridge Works have ordered a standard duplex pump from the Smart-Turner Machine Co., Hamilton.

A large addition will be made to the Waterous Engine Works factory at Brantford by about 4,000 square feet area.

Work has been begun on the construction of the Clergue Railway, the Manitoulin & North Shore, on Goat Island.

John. Fell Mills, of Buffalo, is negotiating with Welland, Ont., with a view to establishing an automobile factory there.

Fire damaged the pulp mills being erected at Grand Falls, N.S., by Sir Alfred Harmsworth, to the extent of $30,000.

Randall & Greenshaw, Shoal Lake, Man., ask the municipality for a loan of $15,000 to build a grist mill and elevator.

The Fairgrieve Co., Toronto, are being supplied with a duplex pump, built by the Smart-Turner Machine Co., Hamilton.

The Cannon Granite Co. have ordered a 10-ton hand-power traveling crane from the Smart-Turner Machine Co., Hamilton.

The comb and novelty works of J. B. Gettman, Berlin, Ont., have been destroyed by fire. The loss will amount to $8,000.

The J. Coulter Co. have purchased a site on Lombard street, Toronto, for $15,000, and will erect a jewelry case factory on the site.

The Smart-Turner Machine Co., Hamilton, are supplying the Port Arthur Sand, Lime & Brick Co. with a standard duplex pump.

The Toronto, Hamilton & Buffalo Railway are making arrangements to enlarge and improve their railway yards in Brantford.

W. J. Holliday, Gananoque, Ont., is reported to be starting the manufacture of a brand of leather not at present made in Canada.

The Smart-Turner Machine Co., Hamilton, are supplying the Lake Simcoe Dredging Co. with a duplex, outside packed, plunger pump.

The Fred. Armstrong Co., Toronto, have ordered an automatic feed pump and receiver from the Smart-Turner Machine Co., Hamilton.

Negotiations are in progress whereby the Detroit United Railway will purchase the franchise of the Windsor and Tecumseh Electric Railway.

A Pennsylvania steel forge company is negotiating with Toronto civic officials for a two acre foundry site on Royce avenue. Fifty men will be employed if the industry is established.

The Town of Napanee, are installing a Smart-Turner independent jet condenser and duplex boiler feed pump in their electric lighting plant.

Alderman J. G. Watson, of Calgary has purchased a site for a stone cutting establishment for which he is now in the east purchasing machinery.

A large saw mill with a capacity of 100,000 feet per day, will be erected at Cumshqua Inlet, B.C., by a syndicate headed by John Moore, Seattle.

The Smart-Turner Machine Co., Hamilton, have received an order for a side suction centrifugal pump, from Messrs. C. Winger & Son, Springvale, Ont.

The Smart-Turner Machine Co., Hamilton, have received an order from the Amherst Malleable Iron Works, Amherst, N.S., for ten tumbling barrels.

The Havelock Electric Light Co. installed another water wheel in their powerhouse last week thereby increasing their plant to the extent of 300 h.p.

Crozier & Elliott, representing the Adjustable Boiler Flue Co., are negotiating with Portage la Prairie with a view to establishing a factory in that place.

Orillia's water works and lighting plant last year made a clear profit of over $2,500, after providing for principal and interest on debentures totalling $318,824.

Southampton ratepayers voted by-laws to lend $15,000 to a furniture company, $10,000 to Sol Knetchel for a machine shop; $5,000 to Chas. Williams for a grist mill.

The Huron & Ontario Electric Railway Co. propose to run their electric line from a point on Lake Ontario to Sarnia, via Beeton, Flesherton, Owen Sound and Goderich.

The planing mill and residence of Mustard Bros., at Websterville, Ont., were burned to the ground together with a large quantity of lumber. The loss is estimated at $12,000 with insurance of $6,000.

The Steel Fence Post Co., of Toronto, has been granted an Ontario charter to manufacture all kinds of wire fencing material and machinery. The directors are H. Buckel and T. Patterson, all of Toronto.

The Smart-Turner Machine Co., Hamilton, have received an order from the Corporation of Port Elgin for their water works pumps, consisting of a compound duplex engine, a boiler feed pump, piping, etc.

The Hamilton & Brantford Electric Railway Co. have contracted with the Dominion Steel Co. for steel rails to be used from Hamilton to Brantford. The contract amounts to [illegible]. eighty-pound rails will be used.

A large deposit of rich iron ore has been discovered south of Verner in the Nipissing district by W. A. Cockburn, Sturgeon Falls. The ore is present in great surface quantity and in a locality convenient to the railway.

Donald Fraser & Sons have decided to rebuild the Aberdeen planing mill at Fredericton, N.B., which was destroyed by fire some time ago. The mill will be equipped especially with machinery for making clapboards, etc.

The Dominion Carriage Co. will build a $60,000 factory in Toronto Junction, instead of in Toronto, because the structural steel in the building was judged too light to comply with the building regulations of the city.

A dynamite manufactory is to be erected on the shores of Burrard Inlet, not many miles from Vancouver. A company of local business men has been formed with R. P. McLennan at its head, which will establish the new industry.

The Golley & Finley Iron Works, Leamington, Ont., have the installation of their machinery about completed, and they will soon be in a position to do all kinds of machine and foundry work. J. J. Hartigan is plant superintendent.

The woodworking factory of Mattinson & Son, Thompson Station, near Amherst, N.S., has been destroyed by fire, causing damage to the extent of $14,000, there being very little insurance. It is not probable that the plant will be rebuilt.

The first open hearth furnace and first blooming mill and combined rod and merchant mill in the vicinity of Montreal will shortly be erected in connection with the Dominion Wire Manufacturing Co. and will cost about half a million dollars.

It is stated that Canada will excell all countries, with the exception of England, in its representation of natural products and manufactured goods at the New Zealand International Exhibition, to be opened at Christchurch, New Zealand, on Nov. 1.

The new buildings of the Alberta Portland Cement Co., Calgary, together with the machinery installed have been burned. The work of rebuilding will be commenced at once. The loss is estimated at from $75,000 to $100,000, with insurance at about $28,000.

A dry kiln, with a capacity of 25,000 feet, has recently been added to the saw mill and planing mill plant of A. McDonald, Peterborough, by the McEachern Heating & Ventilating Co., boiler and engine have recently been added to the equipment.

It is said that a well-known Pittsburg Co. intends going into the electric smelting industry in Canada at some point where power can be obtained at minimum rates. Plans are also being laid for the establishment of electric smelters in Mexico and the United States.

A new stove foundry is to be established at Dorchester, N.B., under the management of Wm. Dowd and H. R. Ficks, formerly of Moncton, but more recently of the United States. The site has been procured and three foundry buildings are now being erected.

The Canadian Pacific Railway Co. have placed orders at their Angus shops for increased passenger equipment, including 20 coaches, 10 baggage and express cars, and 25 box baggage cars.

Messrs. Beatty, shipbuilders, Welland, Ont., have just completed a dredge for the Canadian Dredging & Construction Co., and they have another dredge under construction. Messrs. Beatty will soon be installed in their new works, where the facilities for work will be doubled.

The Oster File Co., of Hamilton, have recently completed a new factory on the corner of Bay and Strachan streets. This step was necessary on account of growing business, making the former quarters too small. A new equipment of machinery for file cutting has been installed.

Woodstock, Ont., will on Sept. 12, submit a by-law providing for a loan of $25,000 to the Canadian Bearings Co., of Hamilton. The company agree to erect three buildings at an expenditure of $10,000, and to install machinery worth $30,000. They will employ at least fifty men.

The Central Foundry Co., an American firm, have decided to locate in Port Hope, the town offering exemption from taxation, with the exception of school taxes. The company are refitting an old radiator plant, and expect to commence manufacturing in a couple of months.

The British Columbia Marine Railway Co., of Esquimalt, has been given the contract by the Dominion Government for the hydrographic steamer to be used on the Pacific. The price is $143,000. The Victoria Machinery Co. tendered at $191,000 and the Polson Iron Works at $202,000.

Steps are being taken towards the fulfillment of the plans of the Shipbuilding Investment Co., Halifax, N.S., for the establishing of a shipbuilding yards at Dartsmouth. Swan & Hunter, the large shipbuilding firm at Wallsend-on-Tyne, Eng., have a controlling interest in the Shipbuilding Investment Co.

The British Columbia Copper Co. has received one of the three mammoth furnaces which it is installing at the smelting works, and it is now on its foundations. The other two will follow soon from Milwaukee, where they are being manufactured. The improvements at smelter and mines will cost about $400,000.

The Montreal Motor Co., Limited, have leased quarters in Montreal, where they will manufacture automobiles. The entire automobile will not be manufactured in Montreal, but the plant will be chiefly for assembling. The engine used will probably be a French one, and the rest of the car will be English.

The Woodstock city council is negotiating with the Canada Furniture Manufacturers, which company purposes to establish at Woodstock a large furniture manufacturing plant, at which from 300 to 600 men will be employed. The city is asked to provide for the loan and the matter will be referred to the ratepayers at an early date.

The British Columbia Power Co., Limited, Vancouver, B. C., have commenced the erection of a dynamite mill on Burrard Inlet, where dynamite will be made which will be different from anything at present on the Canadian market. In the manufacture of the dynamite, nitro glycerine is used with silicate of aluminum as absorbent.

The Canadian Buffalo Forge Co., Montreal, have just completed an installation of down draft forges for the Northern Electric Co., Montreal. This equipment consists of forges with cast iron hoods through which gases are drawn by a suction fan. The forge shop is by this method kept as free from gases as any other of the work shops.

A company who will manufacture stoves, heaters, ranges, etc., has been organized in Owen Sound with a capital stock of $200,000. Allan J. Ross, hardwareman of Owen Sound, will be general manager, and W. S. Hampden, Toronto, superintendent of works. Different improvements and patents are held by the company, which it is said will materially reduce the amount of fuel used.

Allis - Chalmers - Bullock, Limited, Montreal, have been awarded the contract for the electric and hydraulic machinery for the new power house of the Quebec Railway, Light & Power Co., Quebec, which is to be situated one-half mile above Montmorency, on the St. Lawrence River. The power house equipment will consist of a 2,225 h.p. turbine water wheel and a 1,500 k.w. A.C. generator.

W. W. Murray, of the Majestic Wire Fencing Co., a Michigan concern, has been making a trip through Western Canada and has decided to establish factories at Winnipeg and Edmonton for the manufacture of wire fabric for concrete reinforcement, and all kinds of farm and lawn fencing. Mr. Murray expects to have his factories in operation this Fall, and to employ at least 100 men.

Armstrong Bros.' Tool Co., "The Tool Holder People," of Chicago, have just shipped two orders received recently from the Isthmian Canal Commission, aggregating almost one thousand Armstrong tool holders, many heavy sizes being included. They have also received recently an order for universal ratchets for use in the Canal zone. Many smaller shipments had preceded these later and larger oders.

The preliminary arrangements for the Electrical Trades Exposition in the Fall of 1907 were made at a meeting of Montreal firms interested in the proposition, which took place this week. Five thousand dollars, a sum larger than will be required for the preliminary work, has already been subscribed. At the exposition there will be exhibits of all electrical apparatus, as well as that of allied trades.

Sturgeon Falls, Ont., has secured the works of the North Ontario Reduction & Refining Co., which has been organized with a capital stock of $500,000, to provide for the Cobalt and Sudbury districts the smelting reduction and refining works so necessary for that part of the country. It will no longer be necessary to export the ore, and thus the mine owner will save not only his freight charges, but also the valuable by-products.

The Canadian Pacific Railway have in view the running of a line of steamers between Fort William and Goderich, and already contracts have been let for the reclaiming of several acres of Lake Huron for the construction of docks. A large grain elevator will be constructed on the docks, and it is expected that there will be traffic over the steamboat line and over the new C.P.R. between Goderich and Guelph within a very short time.

The Montreal office of the Canadian Westinghouse Co. has had a busy Summer, among the recent installations made by them being a k.w. turbo-generator at the Montreal Light, Heat & Power Co's Queen street station, a switchboard at the Westmount incinerator plant and a four panel switchboard at the Saraguay Electric Light & Power Co's plant, Cartierville. They are also putting in all the electrical equipment for the Soulanges Canal.

There is great difficulty experienced in getting bolts and nuts just now. Factories are rushed to their fullest extent and have contracts for months ahead. The demand has become so large that firms who have heretofore depended upon Canadian manufacturers for their supply now find it impossible to make contracts for anything like early delivery, and have had to place contracts with British firms. All this, of course, tends to firm up prices, and it would not be surprising to see a further advance before long.

The Quebec Railway Light & Power Co., finding that its power from Montmorency Falls proves inadequate at certain times, has entered on an extensive development about half a mile higher up the river. To provide for the season of low water the company has erected there, according to the plans of E. A. Evans, chief engineer and general manager, a dam 84 feet high, the highest in Canada, for such a purpose. It is 67 feet 4 inches wide at the base and 12 feet wide at the crest and will hold back 52,000,000 cubic feet of water.

The firm of Brown, Boveri & Co., Limited, electrical engineers and contractors, Baden, Switzerland, are establishing a branch company in London, Eng., of the same name, to look after the interests of the parent firm in Great Britain, Canada, and other colonies. This company will take over the contracting business of Whiting, Eborall & Co., London, and Mr. A. C. Eborall will be managing director of the new firm. The English Brown, Boveri & Co. will have the whole of the resources and experience of the Swiss company behind it, which firm is now a concern with a capital of £640,000, having works in Baden, Mannheim, Paris, Christiana and Milan.

Companies Incorporated

The Renwick Co., Limited, Toronto; capital, $40,000; purpose, to build and operate steam vessels. Directors are: A. W. McKenzie, D. B. Hanna, L. W. Mitchell, all of Toronto.

Sydney Steamship Co., Sydney; capital, $40,000; purpose, to build and operate steam vessels. Directors are: R. Harrington, J. A. Young, H. C. Harrington, all of Sydney.

The Multi Scale Co., Limited, Guelph; capital, $40,000; purpose, to manufacture scales, known as Multi Scales. Directors are: H. Wright, Geo. Henderson, David Anderson, all of Guelph.

Alfred Prendergast, Limited, Montreal; capital, $20,000; purpose, to manufacture and deal in clothing. Directors are: Alfred Prendergast, S. Munroe and A. Paulin, all of Montreal.

Monarch Motor Co., Limited, Montreal; capital, $250,000; purpose, to manufacture and repair automobiles. Directors are: L. D. Robertson, J. S. Mackenzie, J. D. Warrington, all of Montreal.

The St. Lawrence Canadian Navigation Co., Limited, Montreal; capital, $1,000,000; purpose, to build and operate steam vessels. Directors are: Wm. Paul, L. Lacouture and Jos. Jean, all of Montreal.

Hunt Bros., Limited, London, Ont.; capital, $145,000; purpose, to carry on a general flour and grain milling business. Directors are: C. B. Hunt, J. I. A. Hunt, C. R. Hunt, and G. E. Hunt, all of London.

The Saunderson Mfg. Co., Limited, Sydney; capital, $45,000; purpose, to manufacture and deal in all kinds of roofing material. Directors are: A. E. Collas, A. A. Saunderson, A. L. Melvin, all of Halifax.

The Canada West Coal & Coke Co., Limited, Winnipeg; capital, $2,000,000; purpose, to carry on a mining business. Directors are: J. S. Hough, A. C. Ferguson, C. Williams, and Max Finklestein, all of Winnipeg.

The Arundel Lumber Co., Ottawa; capital, $100,000; purpose, to carry on a lumbering business throughout Canada. Directors are: G. H. Perley, W. G. White, C. E. Read, and F. W. Avery, all of Ottawa.

The Dominion Portland Cement Co., Limited, Montreal; capital, $1,000,000; purpose, to manufacture and deal in cement. Directors are: Henry Domville, J. H. Redpath and H. E. Borradaille, all of Montreal.

The Lamb-Watson Lumber Co., Winnipeg; capital, $800,000; purpose, to carry on a general lumbering business. Directors are: C. R. Lamb, Minneapolis; Otto Lachmund, Arrowhead, B.C.; G. D. Minty, Winnipeg.

British Columbia Timbers, Limited, Montreal; capital, $100,000; purpose, to carry on a general lumbering business throughout Canada. Directors are: A. L. MacLaurin, G. A. Forbes, R. H. Fulton, all of Montreal.

Dominion Carriage Co., Limited, Toronto; capital, $50,000; purpose, to carry on a general carriage manufacturing business. Directors are: Henry Horsman, Toronto; A. G. Horose, London, and J. D. Dort, Flint, Mich.

The Read Timber & Lumber Co., Ottawa; capital, $1,000,000; purpose, to carry on in Canada the business of lumbering. Directors are: C. E. Read, W. G. White, G. H. Berley, F. W. Avery, and Wm. Anderson, all of Ottawa.

Ottawa Pulp & Paper Co., Limited, Ottawa; capital, $25,000; purpose, to manufacture and deal in ground wood pulp, sulphite pulp, paper, cardboard, etc. Directors are: Douglas Armour, V. E. Mitchell, E. T. Surveyer, all of Montreal.

Henry Morgan & Co., Limited, Montreal; capital, $3,000,000; purpose, to manufacture and deal in all kinds of mechanical devices, machinery. Directors are: James Morgan, Montreal; C. D. Morgan, Maisonneuve, and H. M. Morgan, Montreal.

The Canadian Converters' Co., Limited, Montreal; capital, $3,000,000; purpose, to manufacture and deal in all kinds of linen, woolen, cotton, silk or other textile goods. Directors are: A. H. Sims, J. P. Black, G. H. Harrower, all of Montreal.

Berlin Machine Works of Canada, Limited, Hamilton; capital, $500,000; purpose, to manufacture and deal in all kinds of machinery. Directors are: P. B. Yates, L. D. Forbes, F. L. Lane, all of Beloit, Mich.; John Patterson and S. D. Biggar, Hamilton, Ont.

Maple City Oil & Gas Co., Chatham; capital, $40,000; purpose, to prospect for oil and gas and to develop oil and gas finds. Directors are: T. K. Homes, James Innes, A. D. Chaplin, G. W. Cowan, Jas. Simon, W. E. Rispin and M. Egan, all of Chatham, Ont.

The St. Lawrence & Great Lakes Dredging & Wrecking Co., Limited, Montreal; capital, $350,000; purpose, to manufacture and operate dredging plants and dredges. Directors are: H. W. Prendergast, Montreal; W. J. McWhinney and E. P. Brown, both of Toronto.

Allith Mfg. Co. has been incorporated under Ontario charter with a capital stock of $40,000, for the purpose of manufacturing door hangers, hardware specialties, etc. The provisional directors are J. D. Spence, G. A. Walker and J. F. McKee, with head office at Hamilton.

The Canada Metal Co., Toronto, have been granted an Ontario charter with a capitalization of $100,000 to manufacture and deal in metals, and aequire the business carried on by Wm. G. Harris under the name of the Canada Metal Co. The directors are A. G. Harris, F. Harris and W. G. Harris, jr.

New Idea Buckle Co. has been incorporated under Ontario charter with a capital of $60,000, for the purpose of manufacturing all kinds of buckles and lines of hardware. The provisional directors are T. J. McKeown, H. Siemens, B. R. Hawley, R. S. Beaver and Rhoda B. Hall, with head office in Toronto.

The Canada West Coke & Coal Company have been incorporated under Dominion charter with a capital stock of $2,000,000 for the purpose of mining and dealing in coal, oil and metals. The provisional directors are J. S. Hough, A. C. Ferguson, Chas. Williams, Max Finklestein and W. M. Graham, with chief place of business at Winnipeg.

The Page-Hersey Tube & Lead Co., Guelph, has been granted an Ontario charter with a capitalization of $2,000,000 to take over the business of the Page-Hersey Iron & Tube Co., and manufacture and deal in all kinds of metals. The directors are S. P. Grosch, R. C. Donald and T. A. E. World, all of Toronto.

The Dominion Portland Cement Co. have been incorporated under Dominion charter with a capital stock of $1,000,000 for the purpose of manufacturing cement and by-products. The provisional directors are Henry Dornville, J. H. Redpath, H. E. Borradaille, H. N. Chauvin and C. A. Duclos, with chief place of business at Montreal.

St. Canut Lumber, Light & Power Co., Limited, St. Canut, Que.; capital, $250,000; purpose, to manufacture lumber and make furniture, doors, sashes, shingles, etc., and to carry on the business of an electric light, heat and power company. Directors are: S. A. D. Sabourin, E. F. Surveyer, J. N. Weldon, and S. J. LeHuray, all of Montreal.

The Desmarteau Plumbers' Supply Company have been incorporated under Dominion charter with a capital stock of $195,000 for the purpose of manufacturing and dealing in plumbers', tinsmiths' and ironmongers' supplies. The provisional directors are J. A. Desmarteau, H. Hebert, P. Bilaudeau, H. Hamel and J. B. Robert, with chief place of business at Montreal.

The Leclare Lumber Mills, Limited, St. Bonaventure, Que.; capital, $145,000; purpose, to manufacture lumber and carry on a general lumbering business. Directors are: J. L. B. Leclare, Sorel, Que.; A. Daigle, St. Moise, Que.; and J. F. Bugeauld, St. Bonaventure.

The Ambwisen Hydraulic Construction Co., of Canada, Limited, Montreal; capital, $100,000; purpose, to carry on a contracting business in the line of water power development and dredging of all kinds. Directors are: D. S. Walker, R. S. Lea, E. Bradshaw, all of Montreal; W. L. Church, Newton, Mass.; and C. H. Eglee, Brookline.

The Stave Lake Power Co. are building a large dam on Stave River, British Columbia, where an electrical generating station will be built to develop 40,000 h.p. The dam will be 47 feet in height.

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WHEELOCK engine—11 x 28—sailor governor; flywheel pulley; now running; reason for selling, putting in larger; a bargain. Jos. Knox & Co., Stayner.

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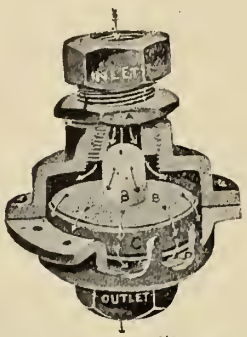

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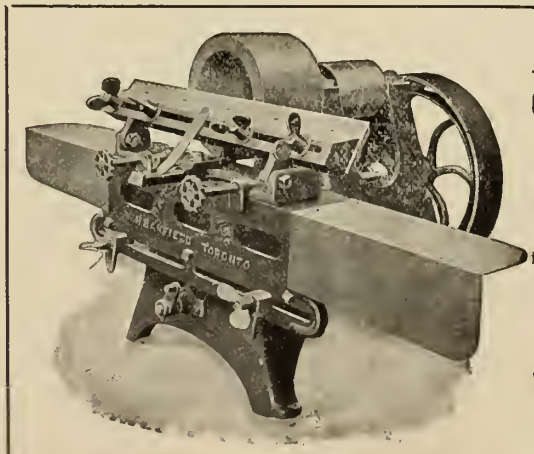

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Dominion Foundry Supply Co., Montreal and Toronto.
R. McDougall Co., Galt, Ont.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Bars, Boring.

Dominion Henderson Bearings, Limited, Toronto.
Niles-Bement-Pond Co., New York.
H. B. Underwood & Co., Philadelphia.

Batteries, Dry.

Berlin Electrical Mfg Co., Berlin, Ont

Batteries, Flashlight.

Berlin Electrical Mfg Co., Berlin, Ont.

Batteries, Novelty.

Berlin Electrical Mfg. Co., Berlin, Ont.

Batteries, Storage.

Canadian General Electric Co., Limited, Toronto.
Chicago Pneumatic Tool Co , Chicago.
Rice Lewis & Son, Toronto.

Bearings, Roller.

Dominion Henderson Bearings, Limited. Toronto.

Bell Ringers.

Chicago Pneumatic Tool Co., Chicago.

Belting, Chain.

The Dodge Mfg. Co., Toronto.
Link-Belt Eng. Co., Philadelphia
Waterous Engine Works Co., Brantford.

Belting, Cotton.

Dominion Belting Co., Hamilton.
Rice Lewis & Son, Toronto.

Belting, Leather.

The Canadian Fairbanks Co., Montreal.
The Dodge Mfg. Co., Toronto.
Rice Lewis & Son, Toronto.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.
Williams & Wilson, Montreal.

Belting, Rubber.

Dodge Mfg. Co., Toronto

Belting Supplies.

The Dodge Mfg. Co., Toronto.
Rice Lewis & Son, Toronto.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.

Bending Machinery.

John Bertram & Sons Co., Dundas, Ont.
Chicago Pneumatic Tool Co., Chicago.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Benders, Tire.

Boynton & Plummer, Worcester, Mass.
Canadian Buffalo Forge Co , Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.

Blast Furnace Brick.

Hamilton Facing Mill Co., Hamilton.

Blowers, Turbine Driven.

Canadian Buffalo Forge Co., Montreal.
Kerr Turbine Co., Wellsville, N.Y.

Blue Printing.

The Electric Blue Print Co., Montreal.

Boilers.

Canada Foundry Co., Limited, Toronto.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Manitoba Iron Works, Winnipeg.
John McDougall Calenonian Iron Works, Montreal.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Boiler Compounds.

Canada Chemical Mfg. Co., London, Ont.
Economical Mfg. & Supply Co., Toronto.
Hamilton Facing Mill Co., Hamilton.

Bolt Cutters.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Bolt and Nut Machinery.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co. New York.

Books, Mechanical.

Technical Pub. Co., Manchester.
The MacLean Pub. Co., Ltd., Toronto.
Spon & Chamberlain, New York

Boring and Drilling Machines.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Boring Machine, Upright.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
London Mach Tool Co., Hamilton, Ont.
Niles Bement-Pond Co., New York.

Boring Machine, Wood.

Chicago Pneumatic Tool Co., Chicago.
London Mach. Tool Co., Hamilton, Ont.

Boring and Turning Mills.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Box Puller.

A. B. Jardine & Co., Hespeler, Ont.

Brass-Washing Machinery.

Warner & Swasey Co., Cleveland, O.

Brushes, Foundry and Core.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Bulldozers.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Calipers.

Brown & Sharpe, Providence, R.I.
Rice Lewis & Son, Toronto.
L. S. Starrett & Co., Athol, Mass.
Williams & Wilson, Montreal.

Cars, Foundry.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co , Hamilton.

Castings, Grey Iron.

Dodge Mfg. Co., Toronto.
Dominion Rock Drill Co., Napanee, Ont.
Jenckes Machine Co., Sherbrooke, Ont.
Laurie Engine & Machine Co., Montreal.
R. McDougall Co., Galt, Ont
Ottawa Steel Castings Co., Ottawa.
Smart-Turner Machine Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.
Allis-Chalmers-Bullock Ltd., Montreal.
Western Machine Co., Stouffville.

Castings, Brass.

Chadwick Bros., Hamilton.
Jenckes Machine Co., Sherbrooke, Que.
R. McDougall Co , Galt, Ont
Ottawa Steel Castings Co , Ottawa.

Castings, Semi-Steel.

Western Machine Co , Stouffville.

Castings, Steel.

Ottawa Steel Castings Co., Ottawa.

Cement Machinery.

Allis-Chalmers-Bullock, Limited, Montrea
St. Lawrence Supply Co., Montreal.
Allis-Chalmers-Bullock, Ltd., Montreal.

Centreing Machines.

John Bertram & Sons Co., Dundas, Ont.
Dominion Henderson Bearings, Limited, Toronto.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co , New York
Pratt & Whitney Co., Hartford, Conn.

Centres, Milling Machine.

The Stevens Co., Galt, Ont.

Centres, Planer.

American Tool Works Co., Cincinnati.
The Stevens Co , Galt, Ont.

Centres, Shaper.

The Stevens Co., Galt, Ont.

Centrifugal Pumps.

Canadian Buffalo Forge Co., Montreal.
R. McDougall Co., Galt, Ont.
D'Olier Engineering Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Centrifugal Pumps—Turbine Driven.

Canadian Buffalo Forge Co., Montreal.
Kerr Turbine Co., Wellsville, N.Y.

Charcoal.

Dominion Foundry Supply Co., Montreal and Toronto
Hamilton Facing Mill Co., Hamilton and Montreal.

Chemicals.

Canada Chemical Co., London.
Economical Mfg. & Supply Co., Toronto.

Chucks, Ring Grinding.

A. B. Jardine & Co., Hespeler, Ont.
Chicago Pneumatic Tool Co., Chicago.
McLean & Sophus, Montreal.

Chucks, Drill and Lathe.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Ker & Goodwin, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
McLean & Sophus, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Rice Lewis & Son, Toronto.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg. Co, St. Catharines.

Chucks, Planer.

American Tool Works Co., Cincinnati.
McLean & Sophus, Montreal.
Niles-Bement-Pond Co., New York.

Chucking Machines.

American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Circuit Breakers.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Clippers, Bolt.

A. B. Jardine & Co., Hespeler, Ont.

Cloth and Wool Dryers.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.

Compressors, Air.

Allis-Chalmers-Bullock, Limited, Montrea
Canada Foundry Co., Limited, Toronto.
Canadian Rand Drill Co,, Montreal.
Canadian Westinghouse Co., Hamilton.
Chicago Pneumatic Tool Co., Chicago.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Allis-Chalmers-Bullock. Ltd., Montreal.

Concentrating Plant.

Allis-Chalmers-Bullock, Limited, Montrea

Concrete Mixers.

Link-Belt Co., Philadelphia.

Condensers.

Canada Foundry Co., Limited, Toronto.
Smart-Turner-Machine Co., Hamilton.
Waterous Engine Co., Brantford.

Confectioners' Machinery.

Pendrith Machinery Co., Toronto.

Consulting Engineers.

Charles Brandeis Montreal.
Canadian White Co., Montreal.
Dominion Henderson Bearings, Limited, Toronto.
Jules De Clercy, Montreal.
John S. Fielding, Toronto.
Roderick J. Parke, Toronto.
Plews & Trimingham, Montreal.
T. Pringle & Son, Montreal.
James C. Royce, Toronto

Contractors.

Canadian White Co., Montreal.
D'Olier Engineering Co , New York.
Expanded Metal and Fireproofing Co., Toronto.
Laurie Engine & Machine Co., Montreal
The Smart-Turner Mach. Co., Hamilton.

Controllers and Starters Electric Motor.

Allis-Chalmers-Bullock, Ltd . Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Allis-Chalmers-Bullock Co., Montreal.
T. & H. Electric Co., Hamilton.

Conveyor Machinery.

The Dodge Mfg. Co., Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Link-Belt Co., Philadelphia.
Smart-Turner Machine Co., Hamilton.
Laurie Engine & Machine Co., Montreal.
Ottawa Steel Castings Co., Ottawa.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Coping Machines.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Core Compounds.

Dominion Foundry Supply Co , Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Core Ovens.

Hamilton Facing Mill Co., Hamilton and Montreal.

Core Oven Bricks.

Hamilton Facing Mill Co., Hamilton and Montreal.

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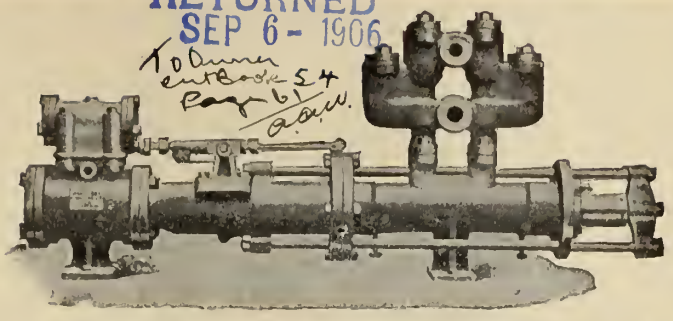
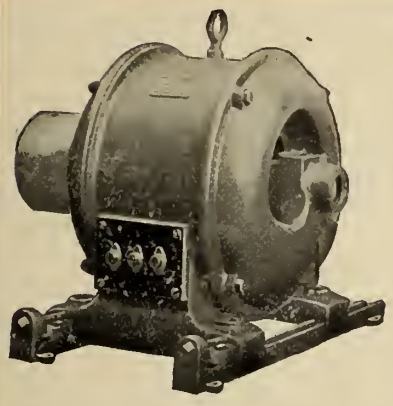
Cranes
Pumps
Condensers



Shafting
Pulleys
Hangers,
etc.

The SMART-TURNER MACHINE CO., Limited, HAMILTON, ONT.



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We Make ***MOTORS*** *and* ***DYNAMOS*** *for Direct and Alternate Currents*

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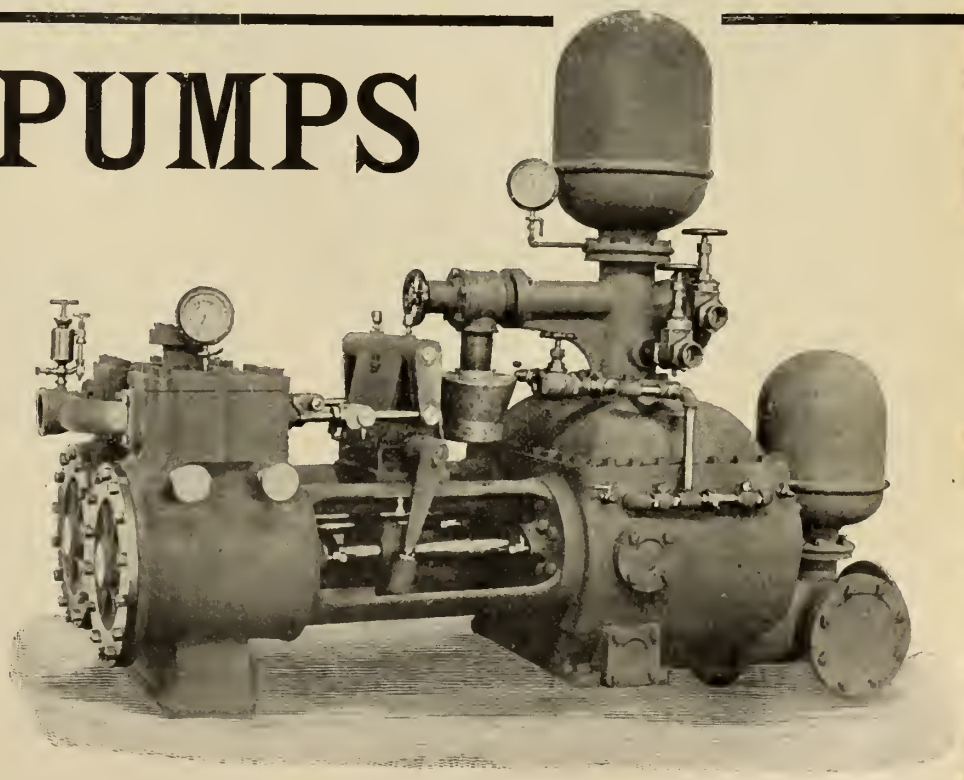
HAMILTON, - ONTARIO

FIRE PUMPS

Save insurance by installing an Underwriter's Fire Pump.



Canada Foundry Company, Limited

HEAD OFFICE AND WORKS, TORONTO, ONT.

District Offices: MONTREAL, HALIFAX, OTTAWA, WINNIPEG, VANCOUVER, ROSSLAND.

Cotton Belting.

Dominion Belting Co., Hamilton and Montreal.

Cranes, Electric and Hand Power.

Canada Foundry Co., Limited Toronto.
Dominion Foundry Supply Co., Montreal aod Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.
Link-Belt Co., Philadelphia.
Niles-Bement-Pond Co., New York.
Smart-Turner Machine Co., Hamilton.

Crushers, Rock or Ore.

Allis-Chalmers-Bullock, Ltd., Montreal.

Contractors' Plant.

Allis-Chalmers-Bullock, Ltd , Montreal..

Crank Pin Turning Machine

London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Crucibles.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Crucible Caps

Hamilton Facing Mill Co., Hamilton.

Crushers, Rock or Ore.

Allis-Chalmers-Bullock Co., Montreal.

Cupolas.

Dominion Foundry Supply Co., Montreal and Toronto
Hamilton Facing Mill Co,, Hamilton and Montreal.

Cupola Blowers.

Canadian Buffalo Forge Co , Montreal
Hamilton Facing Mill Co., Hamilton and Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F Sturtevant Co., Hyde Park, Mass.

Cutters, Coal.

Allis-Chalmers-Bullock, Ltd., Montreal.

Cut Meters.

The Canadian Fairbanks Co., Montreal

Cutters, Flue

Chicago Pneumatic Tool Co., Chicago.

Cutters, Milling.

Becker, Brainard Milling Machine Co. Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.

Cutting-off Machines.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Cutting-off Tools.

Armstrong Bros. Tool Co., Chicago.
London Mach. Tool Co., Hamilton, Ont.
H. W. Petrie, Toronto.
Pratt & Whitney, Hartford, Conn.
Rice Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

Cylinder Boring Bars.

H. B. Underwood & Co., Philadelphia.

Dies, Opening.

W. H. Banfield & Sons, Toronto.
R. McDougall Co., Galt, Ont.
Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal.

W. H. Banfield & Sons, Toronto.

Draft, Mechanical.

W. H. Banfield & Sons, Toronto.
Butterfield & Co., Rock Island, Que.
A. B Jardine & Co., Hespeler.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.

Dowel Pins.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Drawing Instruments.

McLean & Sophus, Montreal.
Rice Lewis & Son, Toronto.

Drawing Supplies.

The Electric Blue Print Co., Montreal

Drawn Steel, Cold.

Union Drawn Steel Co., Hamilton.

Dredges, Gold, Dipper and Hydraulic.

Allis-Chalmers-Bullock Co., Montreal.

Drilling Machines, Arch Bar.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Boiler.

American Tool Works Co., Cincinnati.
Canadian Buffalo Forge Co., Montreal.
John Bertram & Sons Co., Dundas, Ont.
Bickford Drill and Tool Co., Cincinnati.
Boynton & Plummer, Worcester, Mass.
The Canadian Fairbanks Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines Connecting Rod.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Locomotive Frame.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Multiple Spindle.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Bickford Drill & Tool Co., Cincinnati.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Portable

Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
H. B. Underwood & Co., Philadelphia.

Drilling Machines, Radial.

American Tool Works Co , Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Bickford Tool & Drill Co., Cincinnati.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Suspension.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co , New York

Drilling Machines, Turret.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Upright.

American Tool Works Co., Cincinnati.
Canadian Buffalo Forge Co., Montreal
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co. Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
The Canadian Fairbanks Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
W. H. Petrie, Toronto.
Williams & Wilson Montreal.

Drills, Bench.

B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Canadian Buffalo Forge Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.

Drills, Blacksmith.

Boynton & Plummer, Worcester, Mass
Canadian Buffalo Forge Co , Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
New Process Twist Drill Co., Taunton, Mass.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg., Co., St Catharines.

Drills, Centre.

Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
L. S. Starrett Co., Athol, Mass.

Drills, Electric

B. F. Barnes Co., Rockford, Ill.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drills, Gang.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Pratt & Whitney Co., Hartford, Conn.

Drills, High Speed.

Wm. Abbott, Montreal.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
New Process Twist Drill Co., Taunton, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Whitman & Barnes Mfg. Co., St. Catharines.

Drills, Hand.

Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.

Drills, Horizontal.

B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drills, Jewelers.

Pendrith Machinery Co., Toronto.

Drills, Pneumatic.

Chicago Pneumatic Tool Co , Chicago.
Niles-Bement-Pond Co., New York

Drills, Radial.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drills, Ratchet.

Armstrong Bros. Tool Co , Chicago.
A. B. Jardine & Co., Hespeler,
New Process Twist Drill Co. Taunton Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg., Co , St. Catharines.

Drills, Rock.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Drills, Sensitive.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Niles-Bement-Pond Co., New York

Drills, Shop View.

John Bertram & Sons Co., Dundas, Ont.

Drills, Twist.

Chicago Pneumatic Tool Co., Chicago.
Alex. Gibb, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co., New Bedford, Mass.
New Process Twist Drill Co., Taunton, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

Drying Apparatus of all Kinds.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Dump Cars.

Canada Foundry Co., Limited, Toronto.
Dominion Henderson Bearings, Limited, Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.
Jenckes Machine Co., Sherbrooke, Que
Link-Belt Eng. Co., Philadelphia.
Waterous Engine Co., Brantford.

Dust Separators.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.

Dynamos.

Allis-Chalmers-Bullock, Limited Montreal
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
D'Olier Engineering Co., New York.
Packard Electric Co., St. Catharines.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Dynamos—Turbine Driven.

Kerr-Turbine Co., Wellsville, N.Y.

Economizer, Fuel.

Canadian Buffalo Forge Co., Montreal.
Dominion Henderson Bearings, Limited, Toronto.
McEachren Heating and Ventilating Co., Galt, Ont
B. F. Sturtevant Co., Hyde Park, Man.

Electrical Instruments.

Canadian Westinghouse Co.. Hamilton.

Electrical Supplies.

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
London Mach. Tool Co., Hamilton, Ont.
Packard Electric Co., St. Catharines.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Electrically Driven Tools and Machinery.

American Tool Works Co., Cincinnati.
John Bertram & Sons, Dundas.
Canada Machinery Agency, Montreal.
Canadian Westinghouse Co., Hamilton.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Electrical Repairs

Canadian Westinghouse Co., Hamilton.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Emery and Emery Wheels.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Emery Wheel Dressers.

Diamond Saw & Stamping Works, Buffalo
Dominion Foundry Supply Co., Mootreal and Toronto
Hamilton Facing Mill Co., Hamilton
H. W. Petrie, Toronto.
Standard Tool Co., Cleveland.

Emery Wheel Dressers, Cutters.

Diamond Saw & Stamping Works, Buffalo.

Engineers and Contractors.

Canada Foundry Co., Limited, Toronto.
Canadian White Co., Montreal.
D'Olier Engineering Co., New York.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Link-Belt Co., Philadelphia.
The Smart-Turner Mach. Co., Hamilton.

Engineers' Supplies.

Rice Lewis & Son, Toronto.

Engines, Gas and Gasoline.

The Canadian Fairbanks Co., Montreal.
Canadian McVicker Engine Co., Galt, Ont
Dominion Henderson Bearings, Limited. Toronto.
Economic Heat, Light and Power Supply Co , Toronto.
W. Gillespie, Toronto.
The Goldie & McCulloch Co., Galt. Ont.
International Harvester Co., Chicago
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.

Engines, Steam.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian Buffalo Forge Co., Montreal.
D'Olier Engineering Co., New York.
The Goldie & McCulloch Co., Galt, Ont.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
John McDougall Caledonian Iron Works, Montreal.
Laurie Engine & Machine Co , Montreal.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.
Waterous Engine Works Co., Brantford.

Engravers.

Toronto Engraving Co., Toronto.

Exhaust Heads.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Out.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevaut Co , Hyde Park, Mass.

Expanded Metal.

Expanded Metal and Fireproofing Co. Toronto

Expanders.

A. B. Jardine & Co., Hespeler, Ont.

Fans, Electric.

Canadian Buffalo Forge Co., Montreal.
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.
McEachren Heating and Ventilating Co., Galt, Oot.
Sheldon's Limited, Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Fans, Exhaust.

Canadian Buffalo Forge Co., Montreal
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co , Hamilton and Montreal.
McEachren Heating and Ventilating Co., Galt Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass

Feed Water Heaters.

The Smart-Turner Mach. Co., Hamilton.

Files and Rasps.

Rice Lewis & Son, Toronto.
Nicholson File Co., Providence, R.I.
H. W. Petrie, Toronto.
Whitman & Barnes Mfg. Co., St. Catharines.

Deseronto Iron Co.

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DESERONTO, ONT.

Manufacturers of

CHARCOAL PIG IRON

BRAND "DESERONTO."

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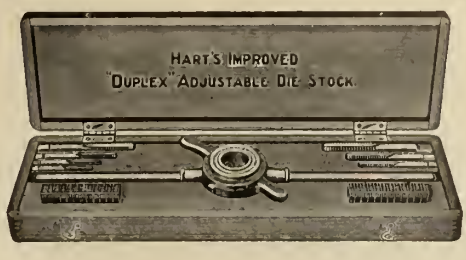

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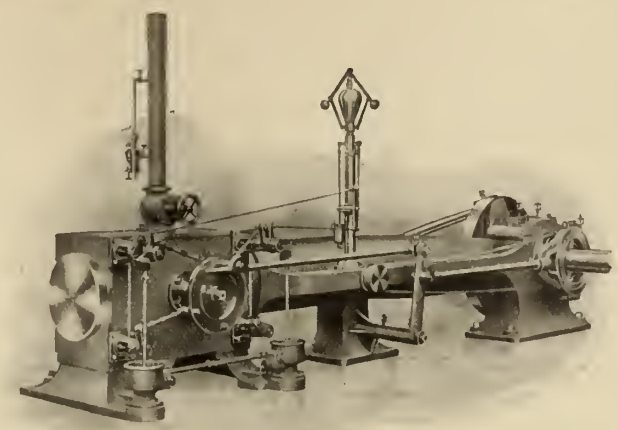

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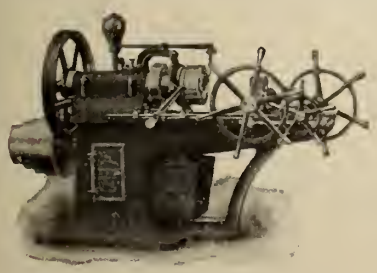

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ALPHABETICAL INDEX.

A

Abbott, Wm. 73
Albany and North River Moulding sand Co. 70
Allis-Chalmers-Bullock Co. ..... Outside back cover
American Tool Works Co 5
Armstrong Bros. Tool Co. 76

B

Barnes, T. W. 71
Barnes, B. F., Co. 3
Banfield, W. H., & Sons 53
Becker-Brainard Milling Machine Co. . 6
Berlin Electrical Mfg. Co. 69
Bertram, John, & Sons ..... front cover
Bickford Drill & Tool Co. 4
Brandeis, Charles 61
Brown & Sharpe Mfg. Co. 75
Budden, Hanbury A. 61
Butterfield & Co. 78

C

Canada Foundry Co. 55
Canada Machinery Exchange 59
Canadian Pneumatic Tool Co 78
Canada Chemical Mfg. Co. 69
Canadian Buffalo Forge Co. 9
Canadian Fairbanks Co. 16
Canagian McVicker Engine Co 67
Canadian Rand Drill Co. 75
Canadian Westinghouse Co. 1
Carr, John 63
Chadwick Bros 70
Chapman Double Ball-Bearing Co. ... 10
Clark-Demill Co. 14
Cleveland Automatic Mach. Co. 9

D

DeCew, J. A. 61
Detroit Testing Laboratory. 61
De Clercy, Jules 61
Diamond Saw and Stamping Works ... 79
Dillon A. & Son. 63
Dodge Mfg. Co. 11
Dods, P. D. & Co. 65
Dominion Foundry Supply Co 71
Dominion Henderson Bearings 10
D'Olier Engineering Co. 69
Dominion Belting Co. 53

E

Economical Mfg. and Supply Co 69
Economic Power, Light and Heat Supply Co. 66
Electric Blue Print Co. 61
"Electrical Times". 63
"Engineering" ..... inside back cover
Engineering Specialties Co 5
"Engineering Times". 63
Expanded Metal and Fireproofing Co. 73

F

Fetherstonhaugh & Co. 61
Fetherstonhaugh & Blackmore. 61
Fielding, John S. 61

G

Gibb, Alex 74
Gillespie, W 66
Geometric Tool Co. 79
Goldie & McCulloch Co. 1
Greening, B., Wire Co. 68

H

Hamilton Facing Mills Co 70
Hamilton Pattern Works 63
Hart Mfg Co. 75
Howard, Geo. H. 9

I

International Harvester Co. 67

J

Jardine, A. B., & Co. 74
Jenckes Machine Co. 72
Jessop, Wm., & Sons 74

K

Ker & Goodwin 76
Kerr Turbine Co. 72

L

Laurie Engine and Machine Co 68
Lewis, Rice, & Son. 80
Link-Belt Co. 68
London Machine Tool Co 2

M

Manitoba Iron Works 68
Mansean, C. 57
McDongal, R., Co 5
McDongall, John, Caledonian Iron Wks 13
McEachern Heating & Ventilating Co. 9
McLean, W. B. & Co. 12
Marion & Marion 61
Merrell Mfg. Co. 72
Mullen, John, & Son 6
Miller Bros. & Toms 63
Morrow, John, Machine Screw Co. 73
Morse Twist Drill and Machine Co. ... 3
Morton, B. K. & Co. 74

N

National Machinery Co. 63
New Process Twist Drill Co. 76
Nicholson File Co. 73

O

Osborn Mfg. Co. 70
Otis-Fensom Elevator Co. inside back cover

P

Packard Electric Co .... inside back cover
Parke, Roderick J. 61
Penherthy Injector Co. 70
Pendrith Mach. Co. 53
Petrie, H. W 15
Plews & Trimingham 61
Potter & Johnston Machine Co 9
Pratt & Whitney Co ...inside front cover
Pringle, T., & Son 65

R

Remington Typewriter Co 69
Ridout & Maybee. 61
Robb Engineering Co. 13
Royce, James C. 61

S

Sadler & Haworth. 62
Sheldons Limited 8
Smart-Turner Machine Co 55
Standard Bolt and Screw Co 73
Standard Tool Co 78
Starrett, L. S., Co. 77
St. Clair Bros. 63
Stevens Co. of Galt. 3
St. Lawrence Supply Co 65
Sturtevant, B. F., Co. 8
Sylvester Mfg. Co. 71

T

Taylor & McKenzie 76
Technical Pub. Co. 80
Toronto and Hamilton Electric Co 55
Toronto Plate Glass Importing Co. 63

U

Underwood, H. B., & Co. 72
Union Drawn Steel Co 66

V

Volta Electric Repair Works. 75

W

Warner & Swasey Co. 3
Waterous Engine Works Co. 12
Wayland Williams & Dadson 67
West Haven Mfg. Co. 79
Wells Pattern & Model Works 63
Western Machine Co 71
Williams & Wilson 7
Whitman & Barnes 77

CONTENTS.

Machinery at the Fair 291
Editorial 297
Profits and Needs of Machinery Manufacturers 299
By M. E. Evans, in Selling Magazine.
Advertising of Manufacturers and Dealers 300
By W. Hull Western.
Foundry Practice 302
Recent Methods of Machine Moulding.
The Molding Cutter. 305
By T. C. Robertson.
Practical Questions and Answers. 306
Tricks of the Trade 307
System in Keeping Tools.
Keeping Cam Records.
Mechanical Reviews 309
An Experiment in Milling Gas Engine Valve Construction.
The Determination of Phosphorus and Ash in Coke.
Relative Power of Two and Four Cycle Engines.
Machinery Development 311
New Prentice Turret Lathe.
Spindle Bolt Cutter.
Planer Type Milling Machine.
New Style of Forge.
New Style of Drill Chuck.
The Detroit Combination Tool.
Grooved Shank Chuck.
About Catalogues 315
Power and Transmission. 316
Westinghouse Variable Speed Motors.
Fairbanks-Morse Gas Producing Plant.
New Rotary Engine.
Stanley A. J. Induction Motors.
I. H. Co. Making Gas Engines.
Correspondence Column 320
Engineering News 321
Convention of C. A. S. E.
Civil Engineers' Excursion.
Engineers Meet at Cardiff.
Electrical Units and Standards.
Personal Mention 322
Industrial Progress 323
Companies Incorporated. 326

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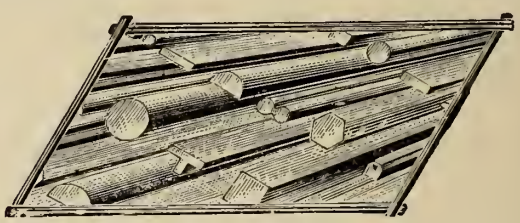

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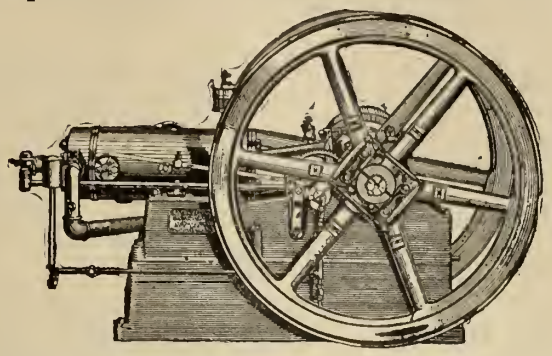

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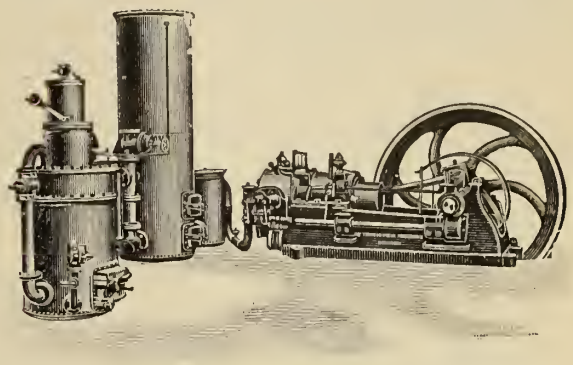

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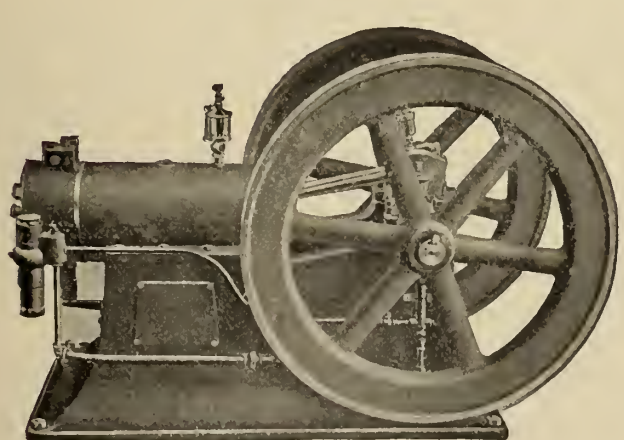

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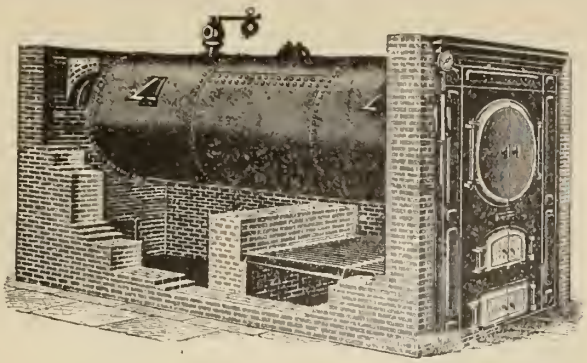

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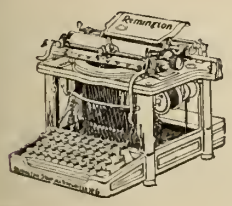

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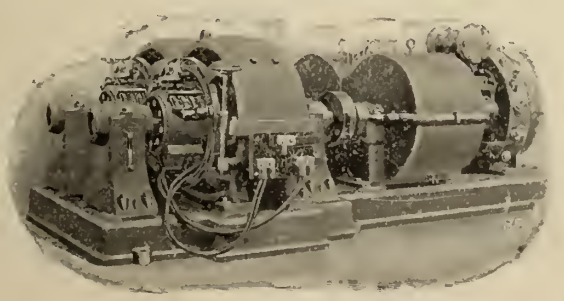

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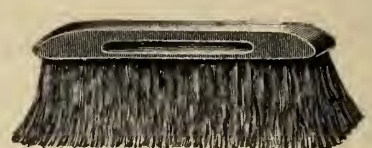

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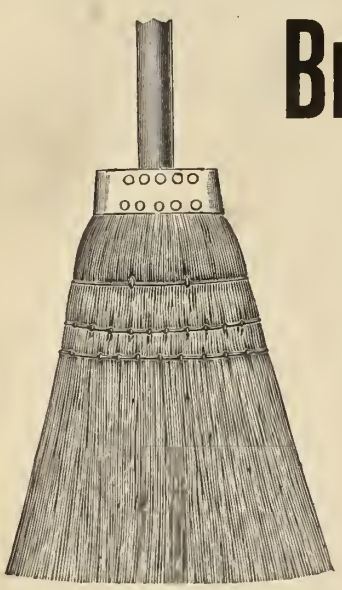

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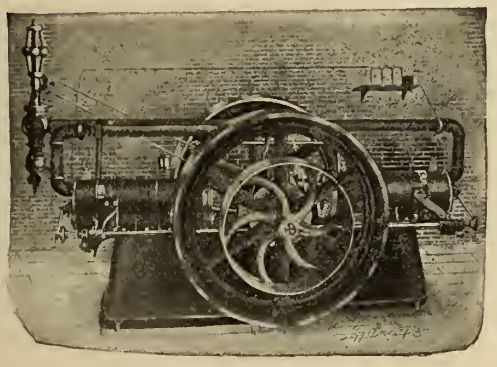

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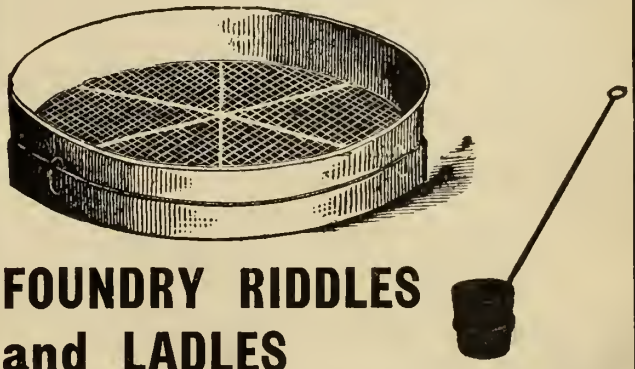

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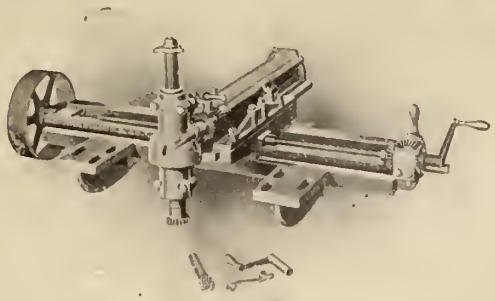

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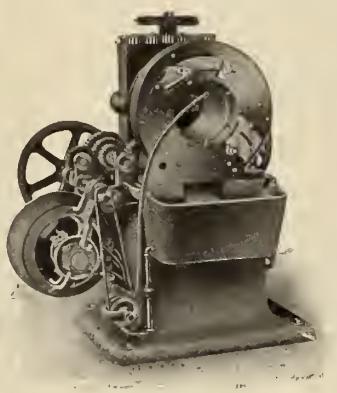

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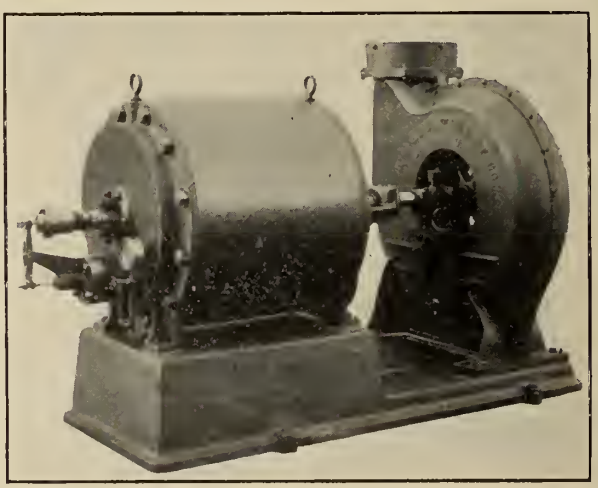

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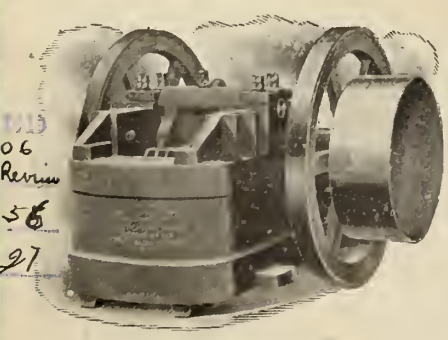

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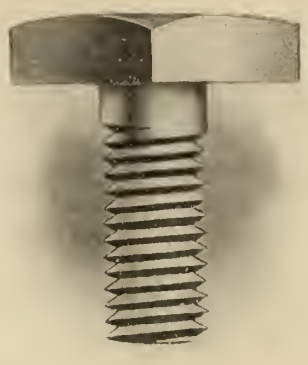

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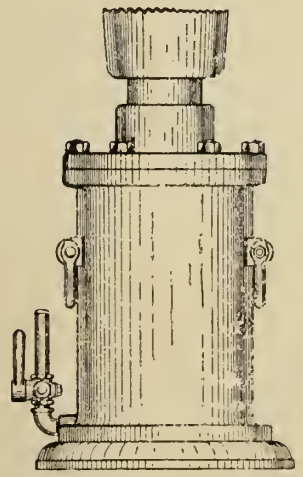

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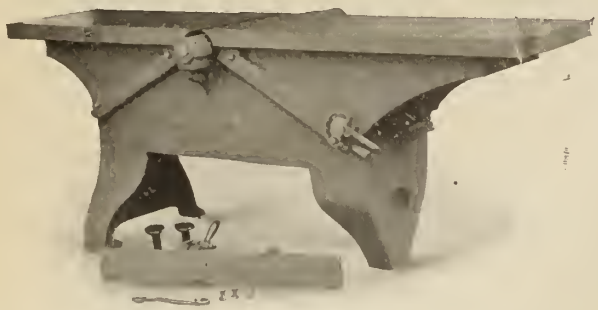

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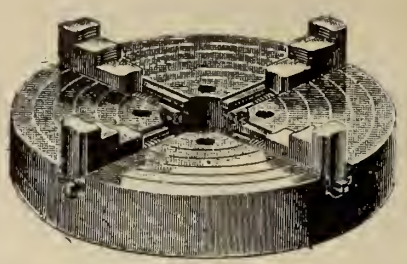

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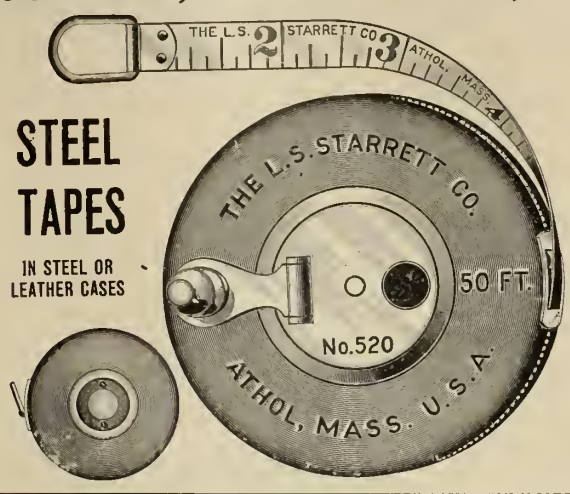

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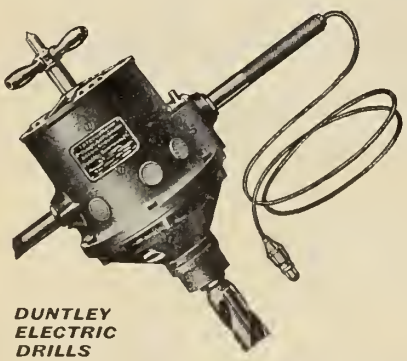

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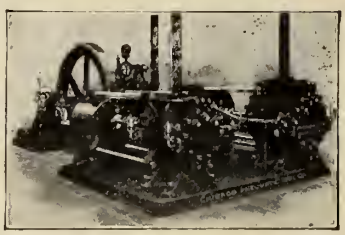

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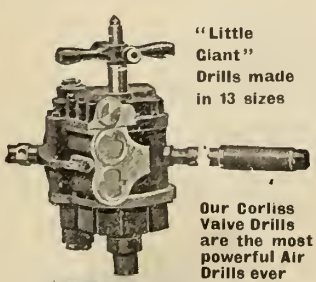

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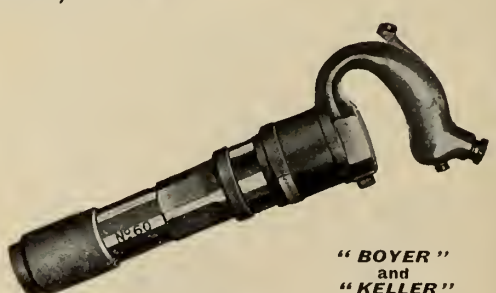

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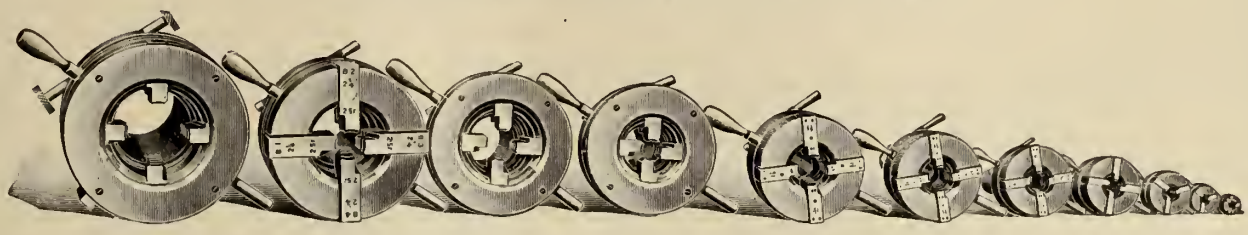

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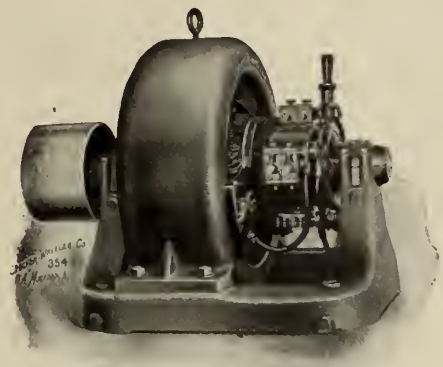

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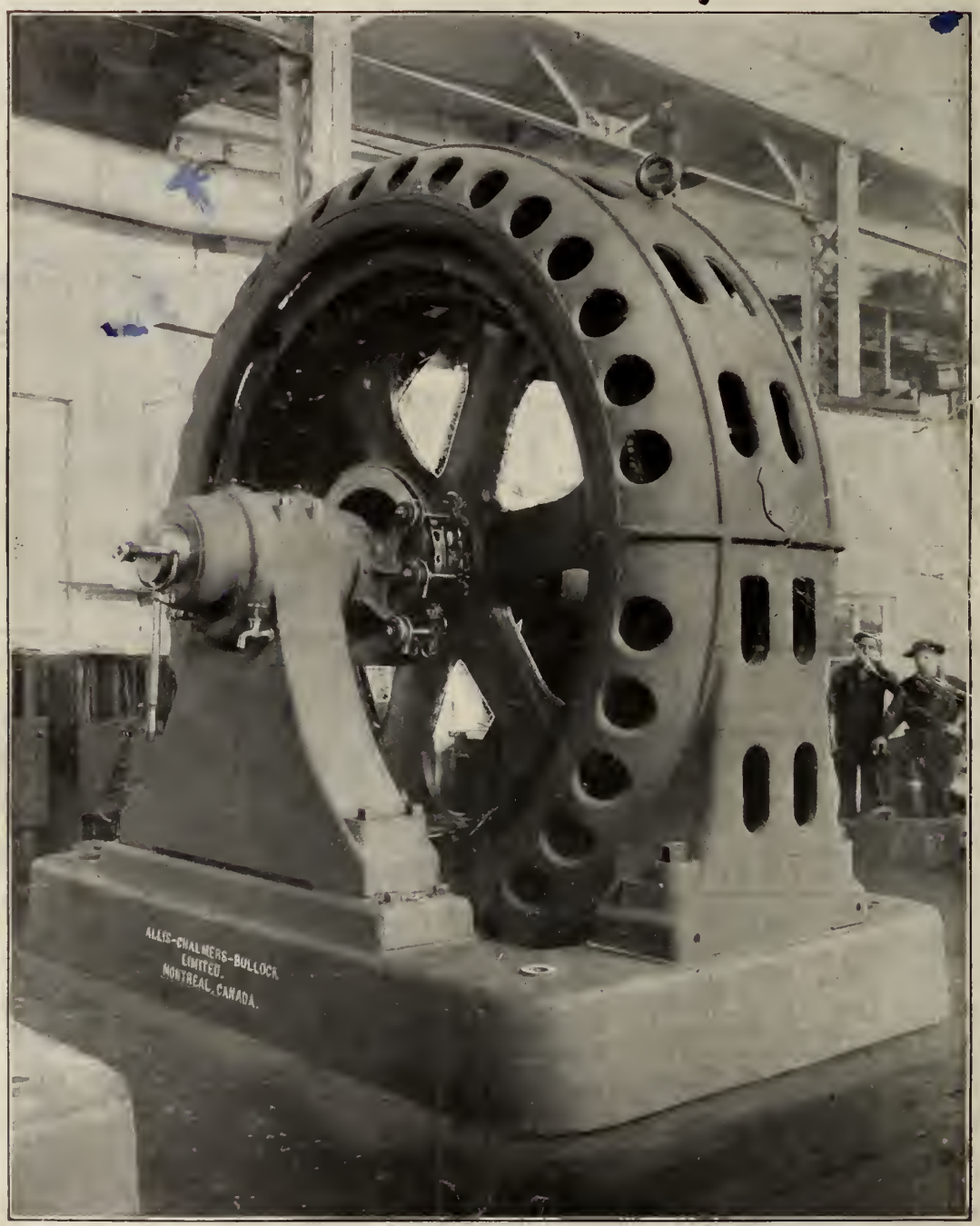

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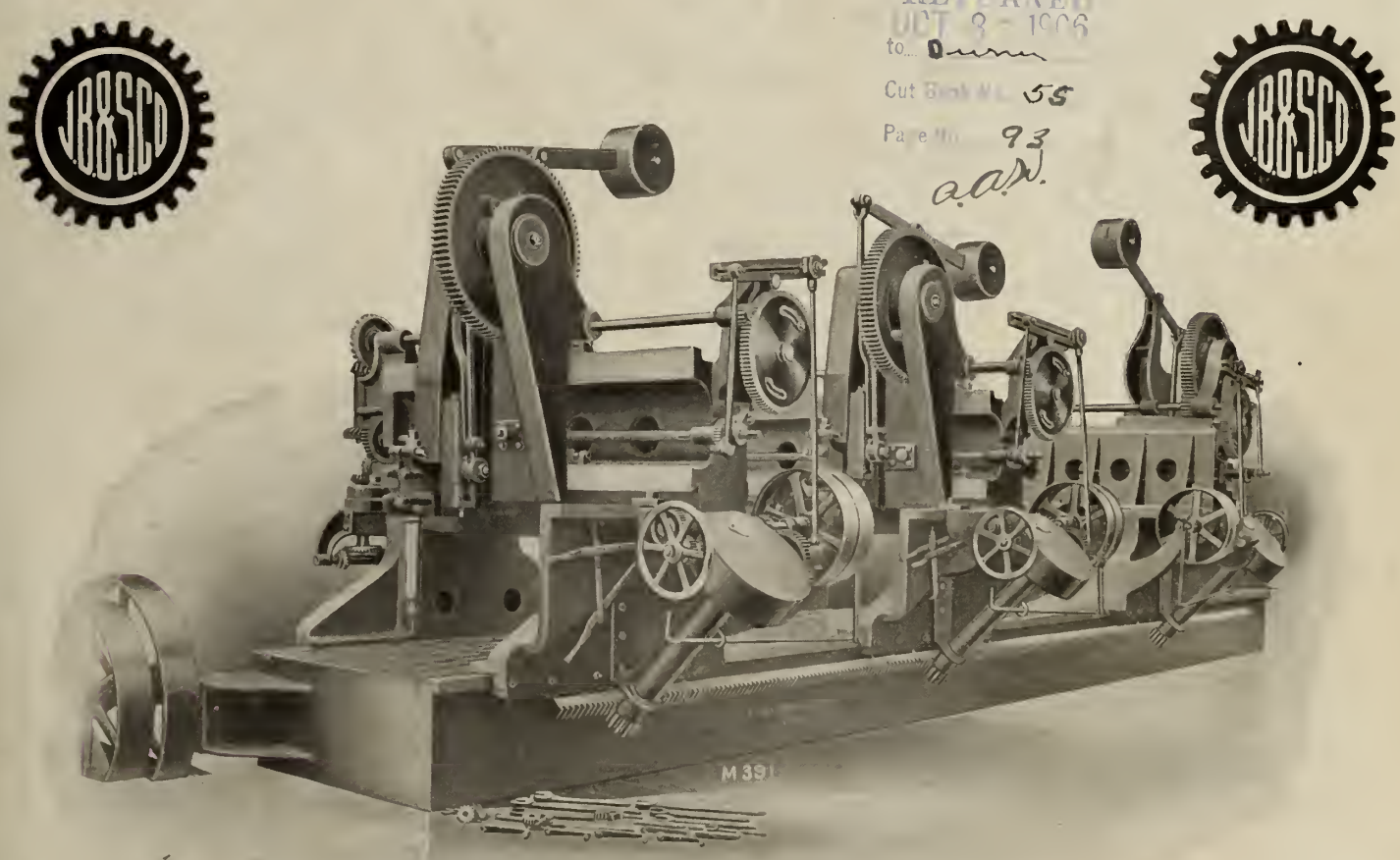

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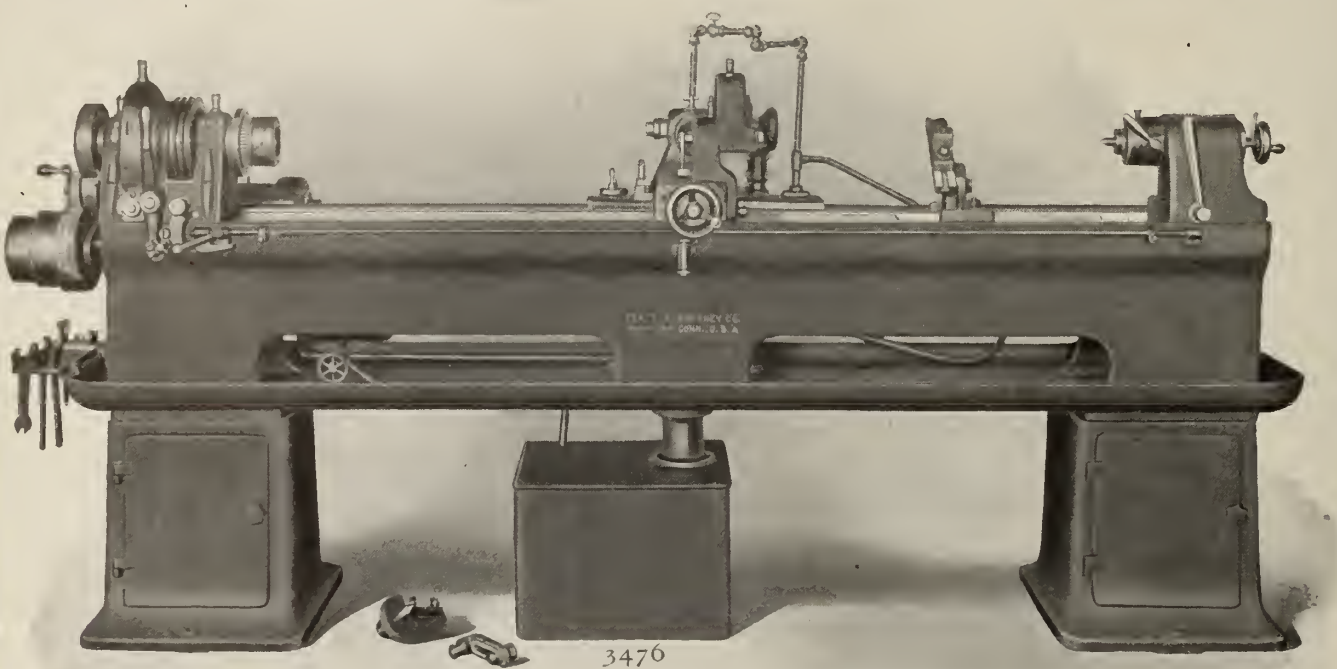

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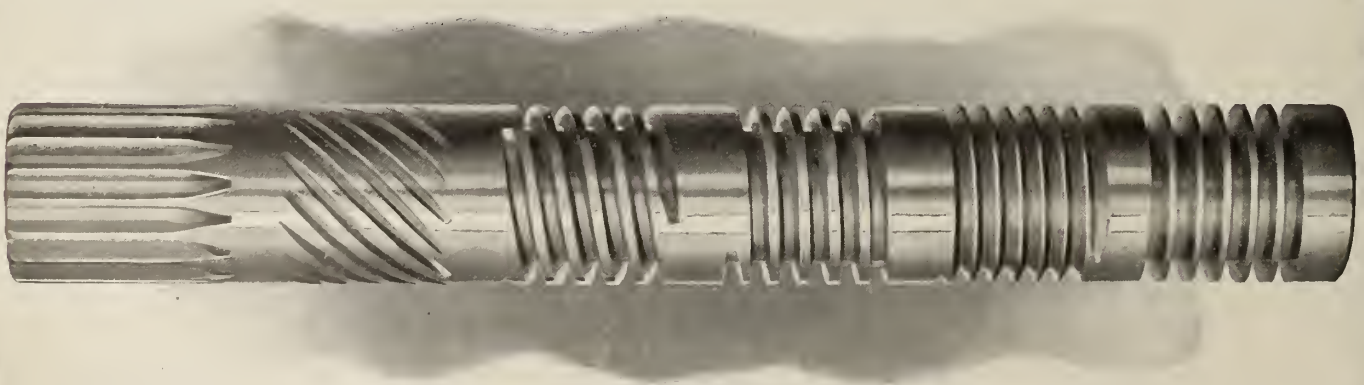

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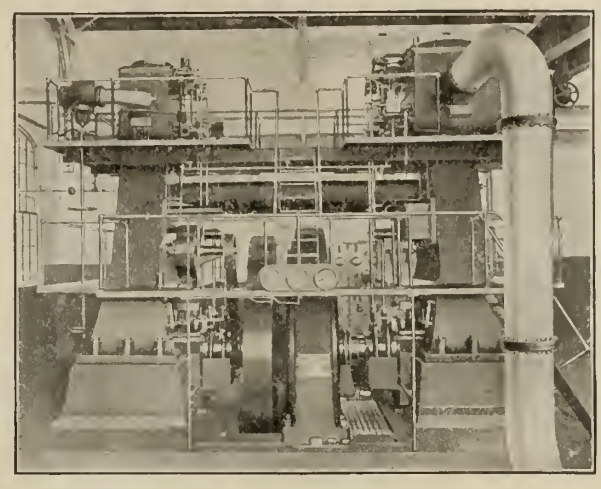

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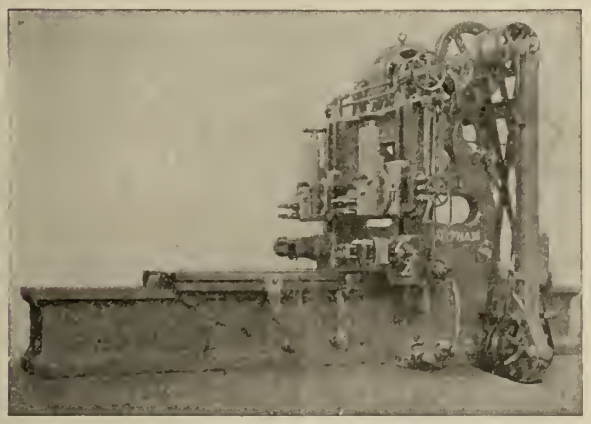

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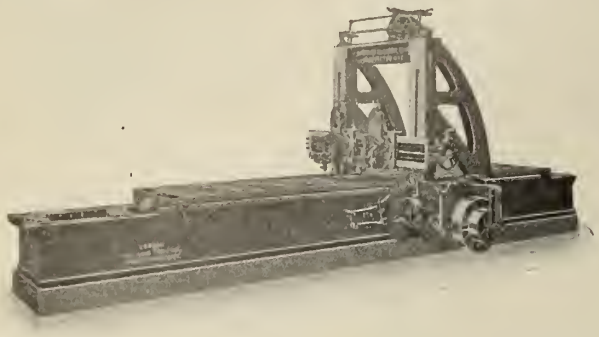

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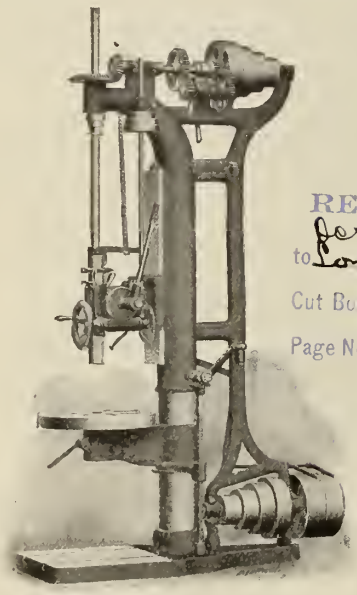

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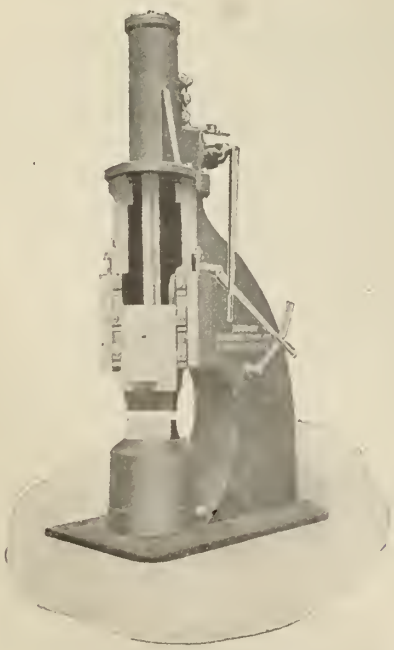

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OUR

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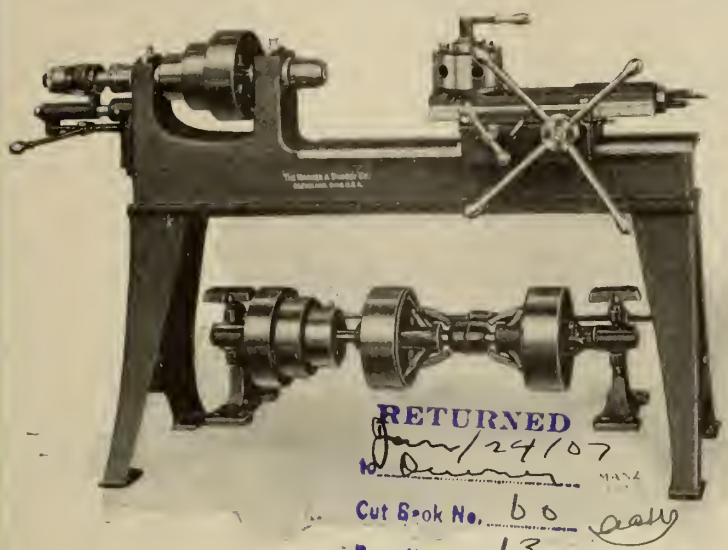

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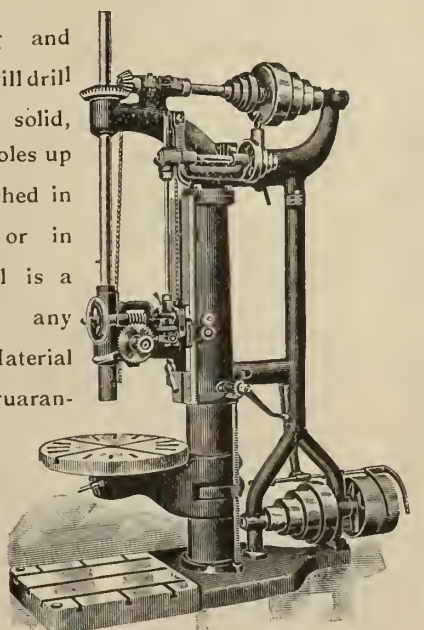

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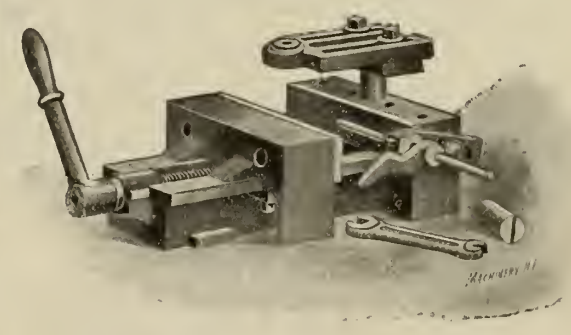

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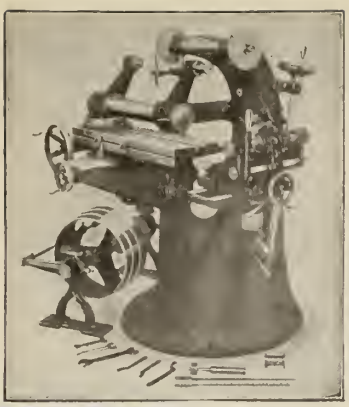

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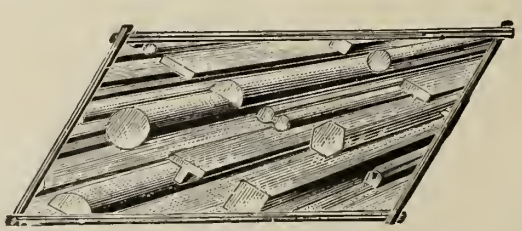

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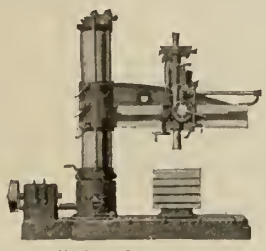

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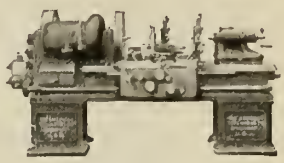

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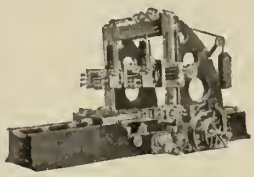

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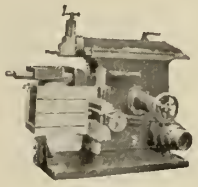

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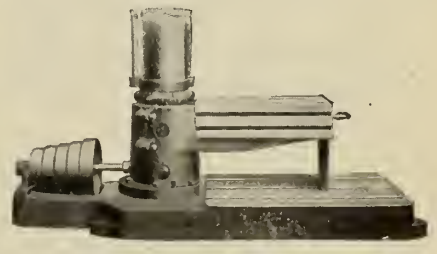
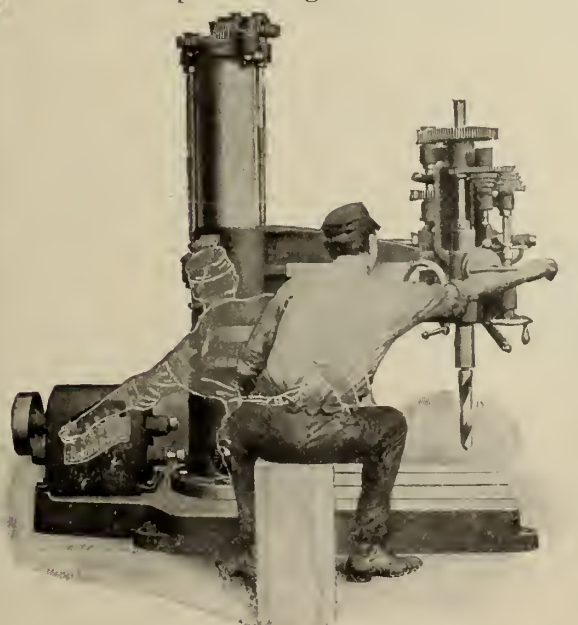


Cone Drive and Swinging Table



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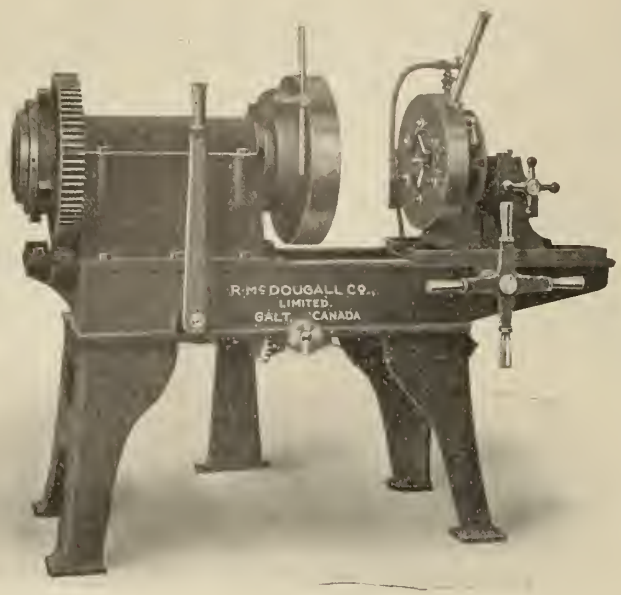

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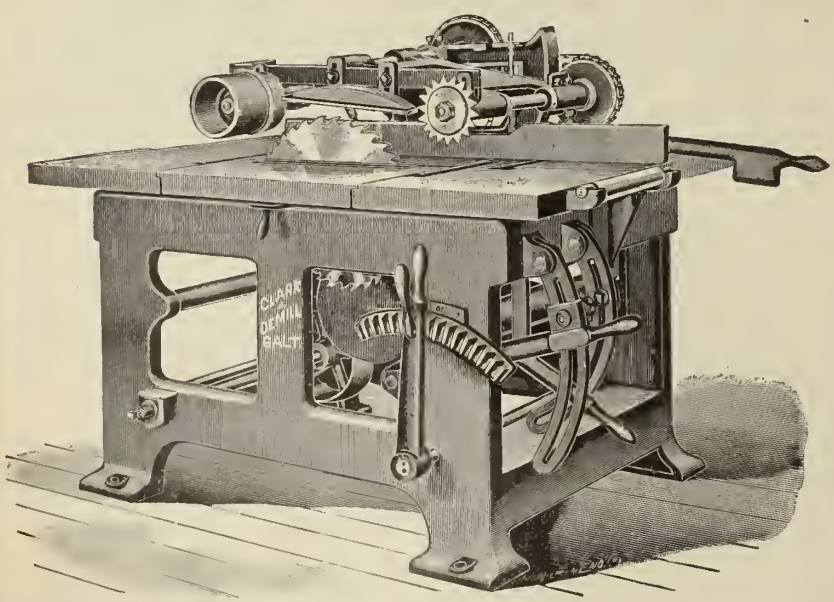

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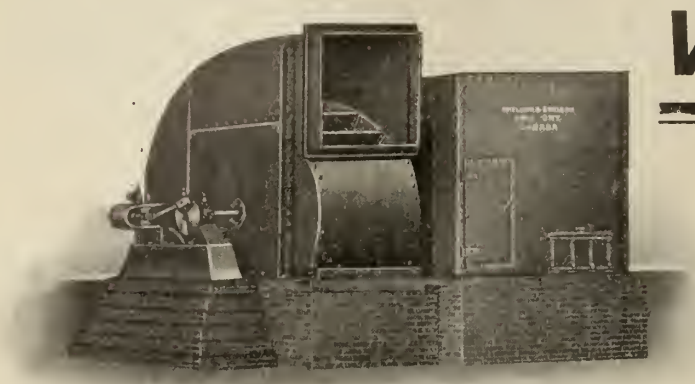

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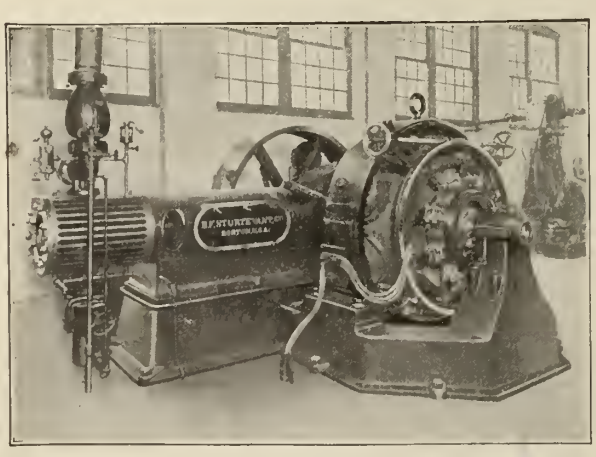

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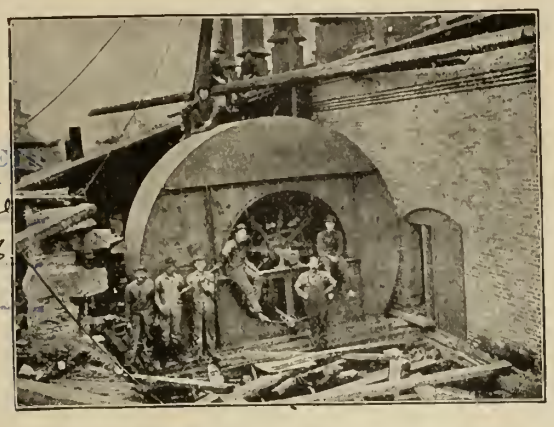

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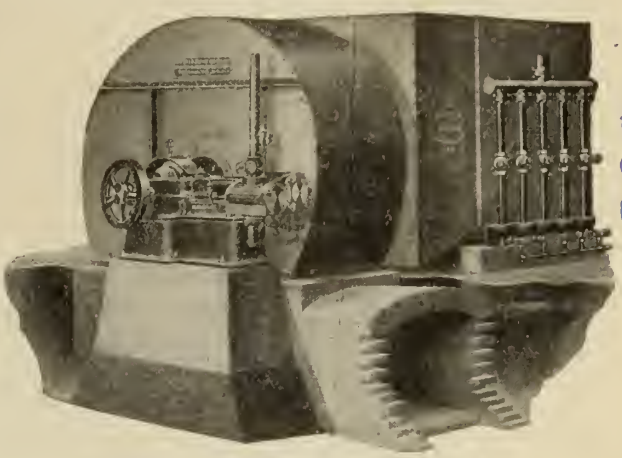

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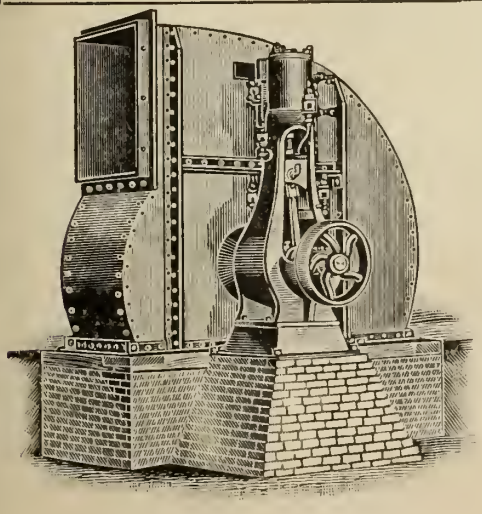

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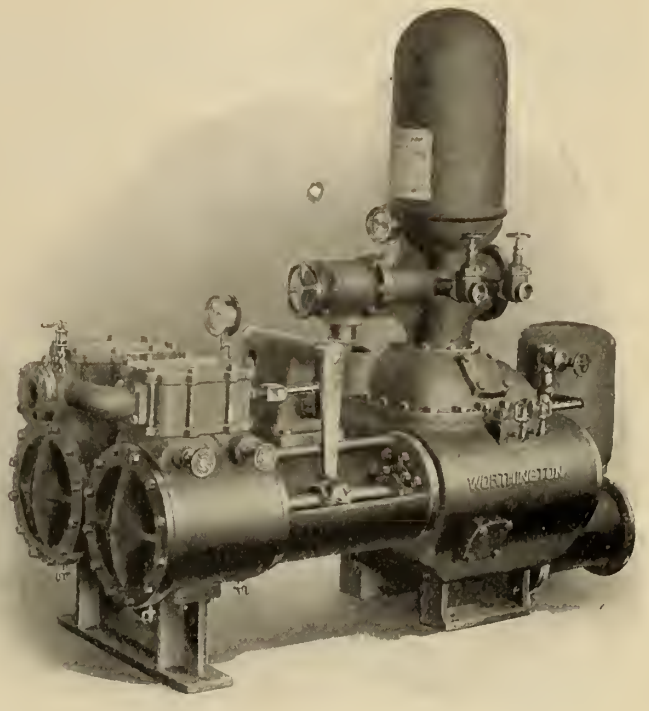

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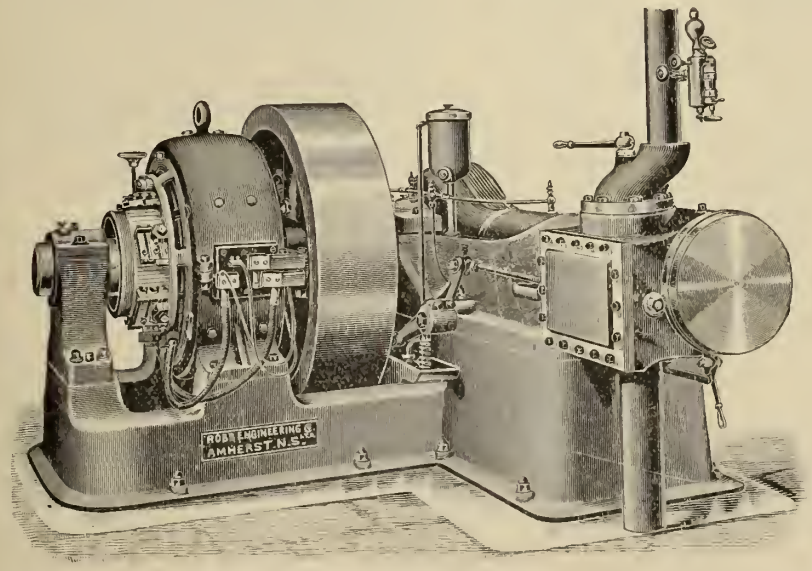

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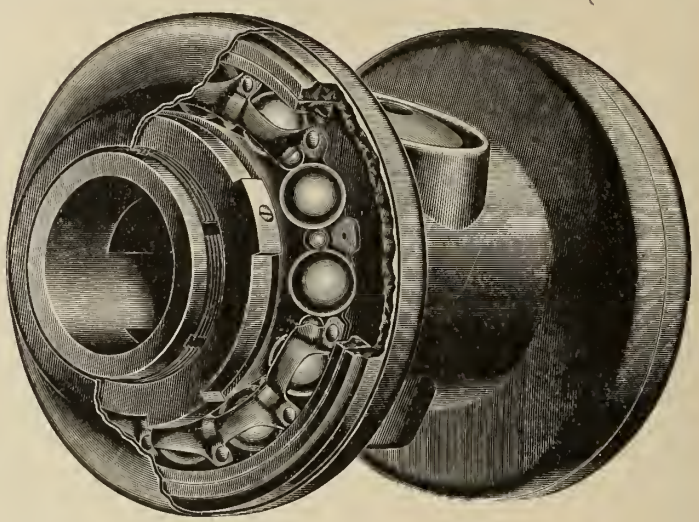

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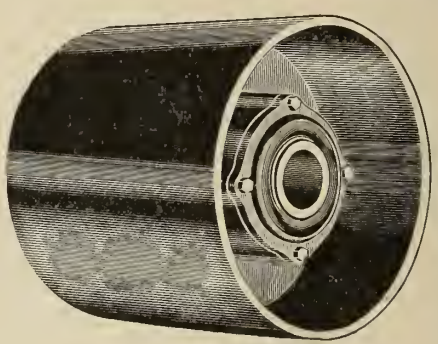

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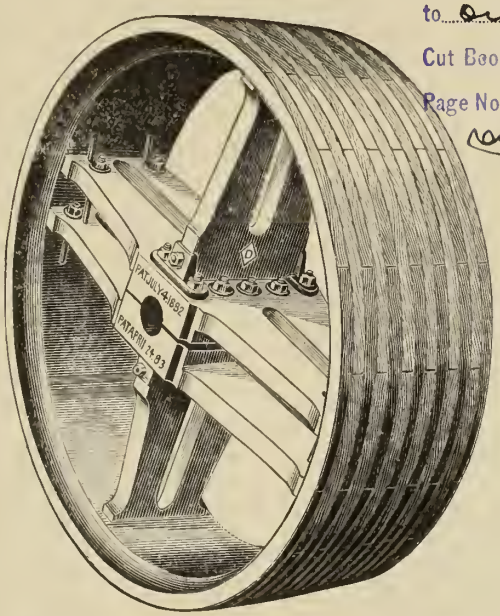

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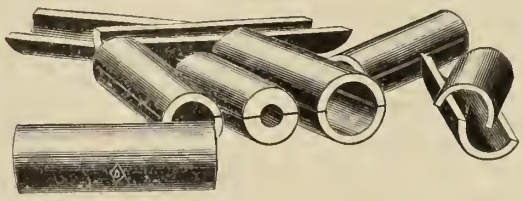

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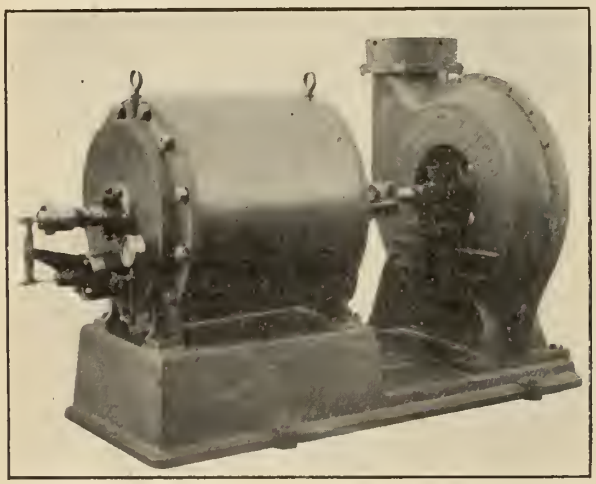

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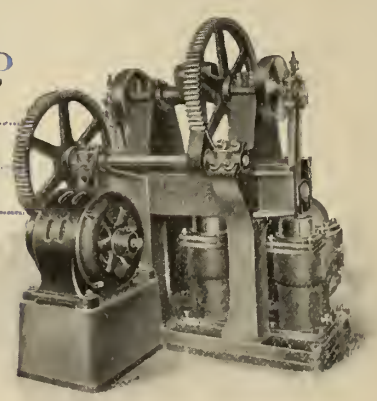

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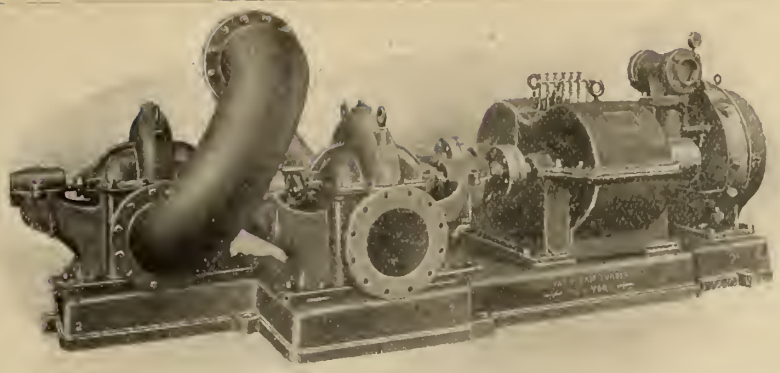

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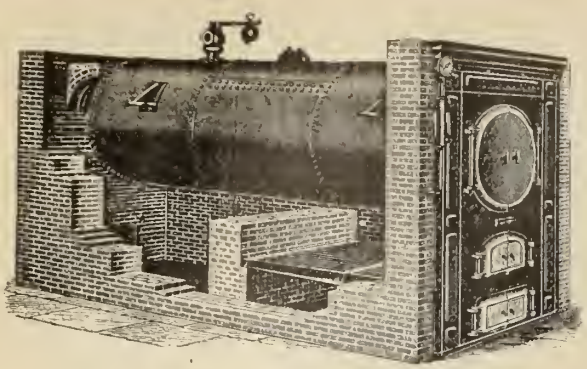

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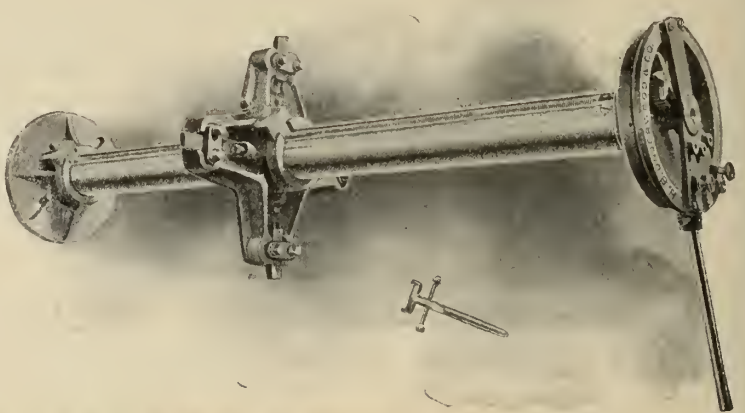

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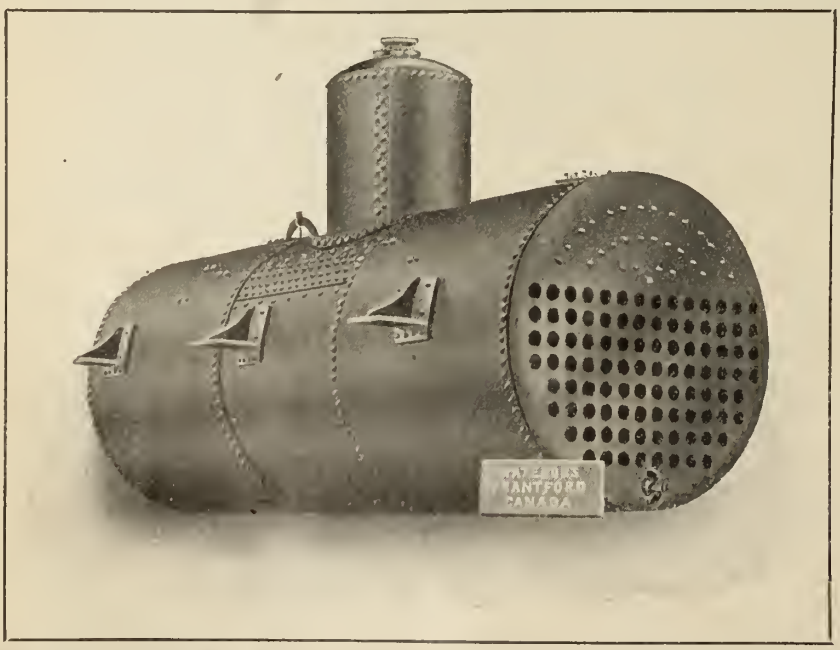

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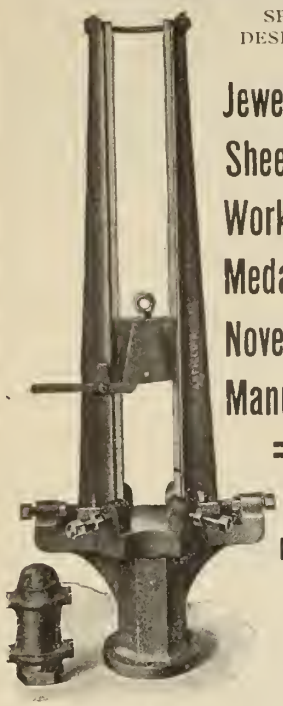

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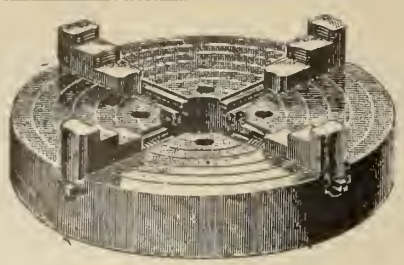

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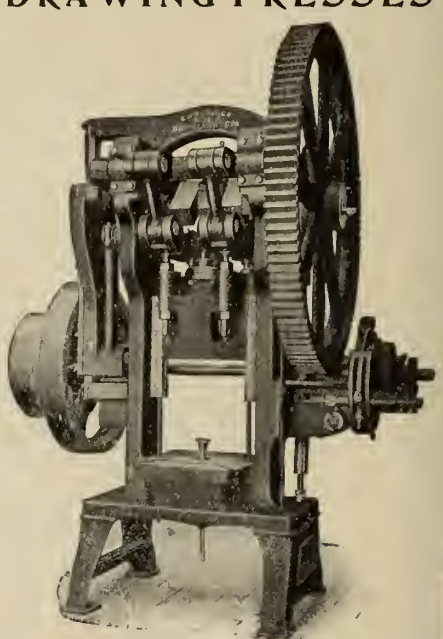

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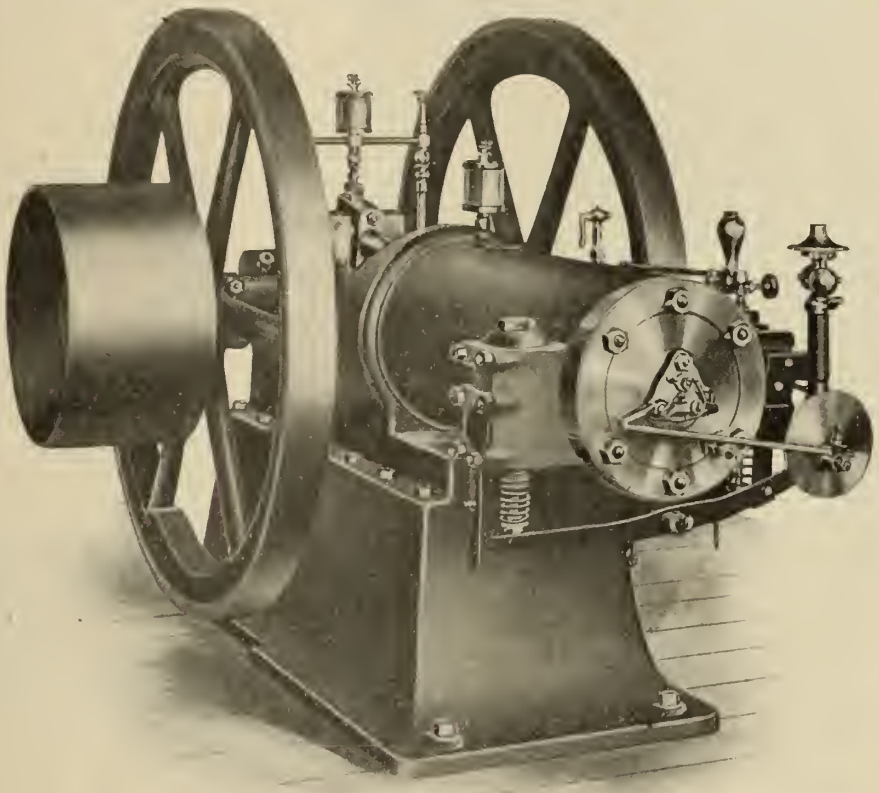

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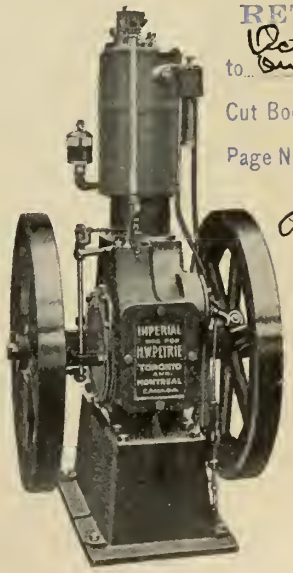

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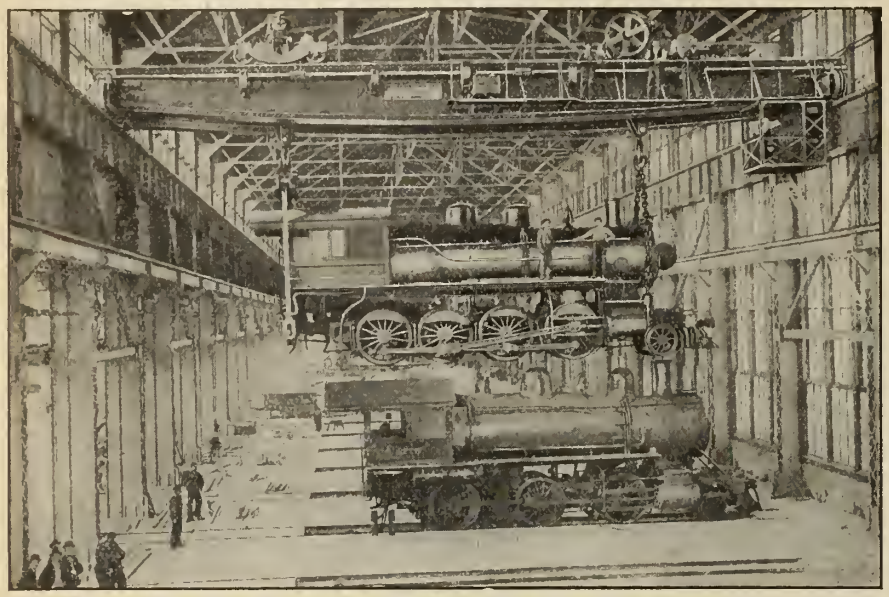

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Modern Canadian Manufacturing Plants.

ARTICLE XIX.—New Plant of The Fairbanks-Morse Canadian Mfg. Co.

THE latest large addition to the industrial development of Canada is the plant of the Fairbanks-Morse Canadian Mfg. Co., established on Bloor street west, Toronto. The last two or three years have witnessed the coming of several large American manufacturing concerns into Canada in the form of Canadian incorporated companies, in which there is more or less Canadian capital. This is done in order that the interest of these companies may be advanced in Canada. In these plants it is evident that as far as possible Canadian labor has been employed, and in the building and equipping of the plants Canadian firms have had the preference, except in the cases of special machinery which has in most cases been imported from the United States. In some plants, of course, this policy has been carried out more minutely than in others.

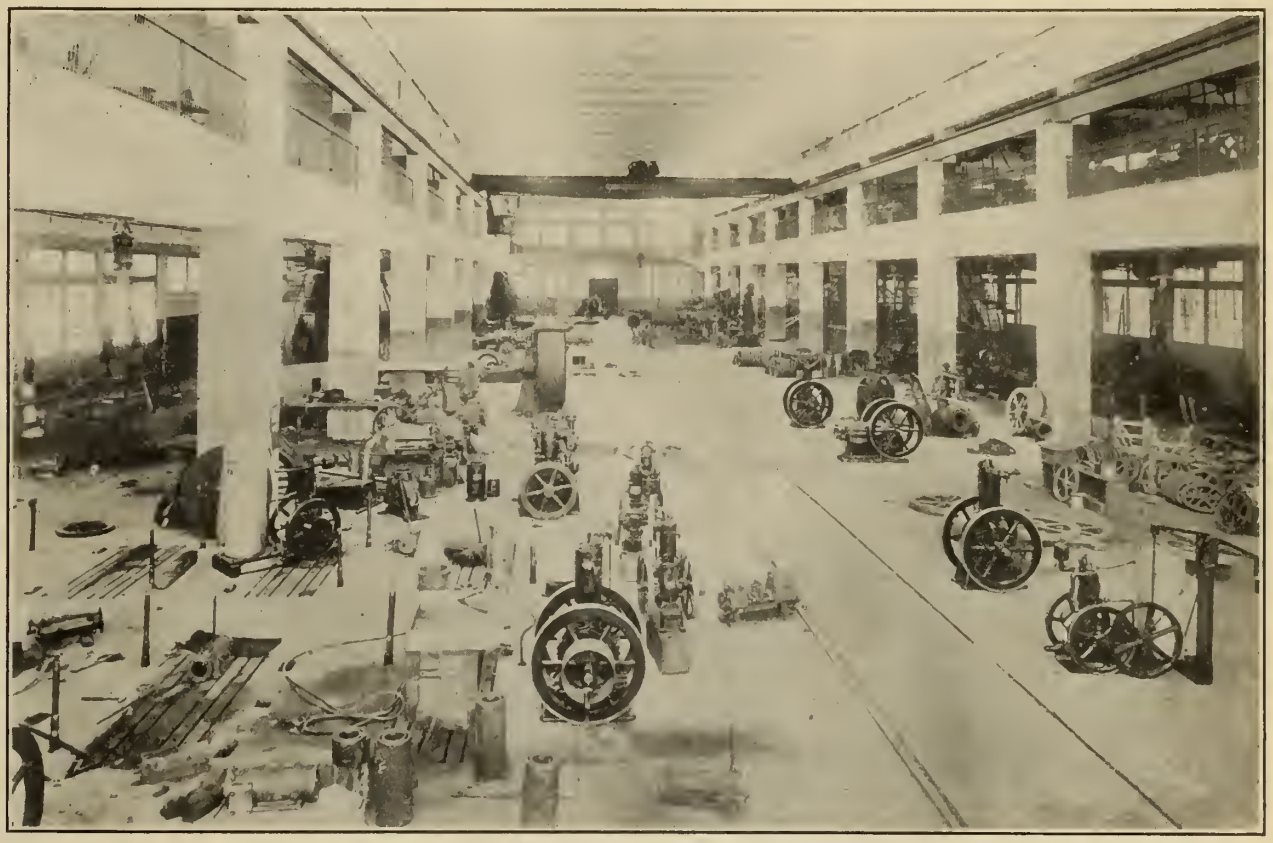

FIG. 1—Fairbanks-Morse Canadian Mfg. Plant—A General View of Machine Shop and Erecting and Testing Floor.

The Fairbanks-Morse Canadian Mfg. Co. has been incorporated in Canada to manufacture in this country the products made in the United States by Fairbanks, Morse & Co., although at present, at least, the product will be confined to gas, gasoline, and oil engines and steam pumps, in order that the advantages of specialization in manufacturing may be secured. The Canadian Fairbanks Co., who are sole Canadian selling agents, through their offices in Montreal, Toronto, Winnipeg and Vancouver, had found that the demand for the Fairbanks-Morse engine and pumps warranted the building of a plant in Canada for their manufacture, and that being the case made arrangements with Fairbanks, Morse & Co., Chicago, to erect a plant to manufacture their lines in Canada. The result has been the combining of interests to the extent of nearly a million dollars in a plant in Toronto.

The site of the new plant is situated between the Grand Trunk and Canadian Pacific Railways, at 1379-1387 Bloor street west, Toronto, on a lot 10 acres in extent, which will allow amply for extensions. The plant as at present established consists of four buildings—the machine shop, 285 x 106 ft.; the foundry, 72 x 130 ft.; the blacksmith shop, 72 x 98 ft., and the power house. The arrangement of the shops is shown in the accompanying plan, Fig. 2. The company have sidings from the G.T.R. as shown, and have tracks running into the south end of the machine shop, which section constitutes the erecting floor, and also tracks between the power house and foundry, as shown, to supply coal conveniently. Thus the company have good shipping facilities.

All the buildings are reinforced concrete construction, with concrete foundations and floors. This construction includes roof, roof girders, as well as columns and walls. For communication

between the buildings and around the yard, there is a system of industrial railways. The heating and ventilating system for the plant was installed by the galleries. Practically all the machines on the ground floor are placed under the galleries with the exception of the larger machines, which project

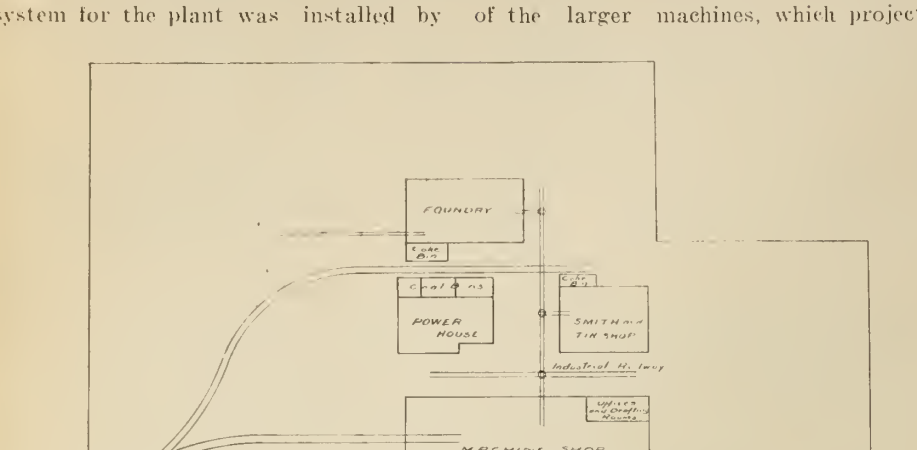

FIG. 2.—Fairbanks-Morse Canadian Mfg. Plant.—Plan of Plant.

the B. F. Sturtevant Co., and is the hot-blast system, the fan and motive power being a standard Sturtevant unit, and the hot air blast being conveyed to different parts of the plant through concrete conduits, which are tapped through the floor wherever necessary, the openings being provided with draft regulators and grating. The buildings are lighted by Adams-Bagnoll arc lamps, the system being installed by the Keystone Engineering Co., Toronto.

The Machine Shop.

The machine shop is situated in the main building, which constitutes the erecting shop and shipping department as well. This building might be said to consist of three bays, in that there are two lines of columns extending down the building, the centre bay being opened for the two stories, while the side bays are each provided with a gallery. The main or centre bay is served with an 8-ton Niles electric traveling crane, operated by Fairbanks-Morse D.C. variable speed motors, the travelways being supported on the reinforced-concrete columns. This shop is lighted by a double row of windows along the sides and ends, and by a skylight over the centre bay extending the entire length of the building. The windows and skylights are provided with metallic frames, with ribbed glass in the windows and wire glass in the skylight. The building is practically fire proof inside and out, the stairs to the galleries even being made of concrete. The floor of the building is concrete, as before mentioned, and is covered with three inches of pine and maple flooring. The machines in the shop are driven in groups, by D.C. Fairbanks-Morse motors operating upon the three-wire system, the sections of shafting running down the middle of the side bays under considerably into the centre bay. This leaves ample floor space for the handling of the parts to be machined. Looking down the shop one is impressed with the appearance of lightness and roominess which it presents. The shafting throughout the plant is equipped with Chapman double ball bearings, which are giving entire satisfaction. A general view of the machine shop, erecting floor and shipping department is given in Fig. 1.

One of the most striking features of the machine shop equipment is a large planer-type milling machine, built by the Ingersoll Machine Co. This machine is shown in Fig. 3, and is equipped, as may be seen, with four milling heads, two vertical and two horizontal. The machine is for general work, but is chiefly engaged in machining engine bases and water boxes. Other special tools are a Gisholt turret lathe, two American semi-automatic turret lathes, two Pratt & Whitney automatic turret lathes, a Bausch multiple spindle drill, a B. F. Barnes gang drill, a special radial drill built by the Fosdick Machine Tool Co., a horizontal boring mill made by Beaman & Smith, and Brown & Sharpe grinders, milling machines and automatic gear cutters. All the standard tools, including lathes, planers, drills, boring mills, key seaters and shapers, are John Bertram tools. Fig. 4 shows a group of these tools, including a large planer on which engine beds are machined, a number at a time, and also in the foreground a standard radial.

Tool Room and Grinding Department.

In the balconies are situated the tool room, the grinding room, and the small erecting floor and store room. In the grinding room is a group of four grinders made by the C. H. Besley Co. and the Gardner Machine Co., on which is done standard work usually performed on milling machines. For work that does not require extreme accuracy this grinding method of finishing certain parts is found to be very satisfactory. Each of the machines is provided with a suction draft dust conveyor, which eliminates the dust nuisance.

In the tool room are made all the tools and jigs used in the shops, and, therefore, it has a very complete equipment. This equipment consists of Brown & Sharpe grinders, Gould & Eberhardt gear cutters, Brown & Sharpe milling machines, American Tool Works shaper, two Hendley Machine Co.'s lathes and a Barnes drill. Fig. 5 is a view of the tool room.

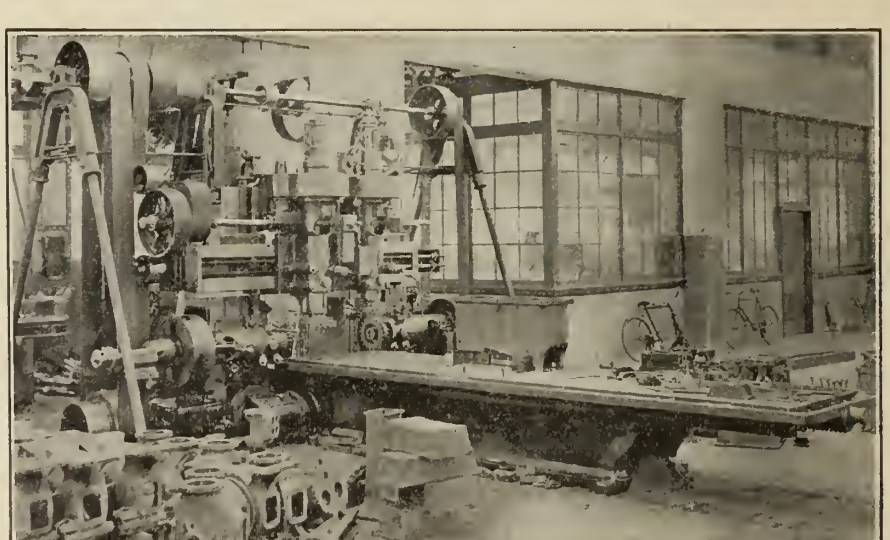

FIG. 3—Fairbanks-Morse Canadian Mfg. Plant—Ingersoll Machine Co.'s Milling Machine.

The Duplicating of Parts With Jigs.

A feature of considerable interest in this plant is the system of manufacturing parts for the engines. As is known,

the parts of the Fairbanks-Morse engines are standard, and each part is specified so that any part of an engine can be replaced by the company on request. In order that each similar part for one engine be accurately duplicated a special jig is made for the matching of each. The advantage of having parts of engines interchangeable is very apparent, and the value of this to the sales department makes up fully for the extra manufacturing investment. These jigs are kept in the tool storage room, and they are looked after in the same way that tools are. The tool room system adopted is as follows: Each mechanic upon entering the employ of the company is supplied with a number of tool-room checks, six in this case, for which he is held responsible. When he wishes a tool from the tool room he is required to substitute one of his checks for the tool. This prevents any one mechanic having more than six tools or jigs out at the same time. Of course all tools needing repairing go to the tool room, and while they are in his department the foreman of the tool room is responsible for them.

FIG. 4—Fairbanks-Morse Canadian Mfg. Plant—A Section of the Machine Shop.

Testing and Shipping Floor.

Before leaving the shop every engine is erected and given a thorough test, the method of rating being by brake horse power. For convenience in testing the testing floor is provided with cast iron bed plates, to which the engines can be bolted down, and close at hand are underground connections for gasoline, gas, water and exhaust. In the foreground of Fig. 1 are shown several engines ready for shipment and also several others undergoing a test.

The Foundry.

The company are well satisfied with the work being turned out from their foundry, and they have good reason to be. One has only to make a casual examination of one of the castings to know that good work is being done in that department. The chief features of interest in the foundry is the set of three Griffith molding machines, which are used in the molding of complicated parts. A complete description of these machines will be given in a later issue of Canadian Machinery. A view of the foundry is given in Fig. 6. The building is served with an 8-ton Niles electric crane, and it is also equipped with pneumatic hoists on travelways. The chipping and cleaning department is equipped with R. McDougall tumbling barrels, an important feature of which is the suction draft apparatus for removing the dust. The cupola was supplied by the Whiting Foundry Equipment Co. The charging floor of the cupola is reached by an electric elevator and the fan supplying draft for the cupola is motor driven.

The Forge and Tin Shop.

Here the crank shafts for the engines are forged, and the water and gasoline tanks for the portable engines are made. One corner is also used as a pattern shop. The outstanding features of the equipment of the building are a bulldozer made by Williams, White & Co., and a John Bertram steam hammer, which has of late been used as a pneumatic hammer. This department is also equipped with a shear made by the Niagara Machine & Tool Works, and a band saw and a surfacer supplied by H. W. Petrie. The shafting is, of course, driven by a D.C. Fairbanks-Morse motor.

Power House.

Undoubtedly the most interesting feature of this plant is the power house. Here there is in operation a complete producer gas electric generating plant, and there is not a sufficient number of these plants in operation in Canada to

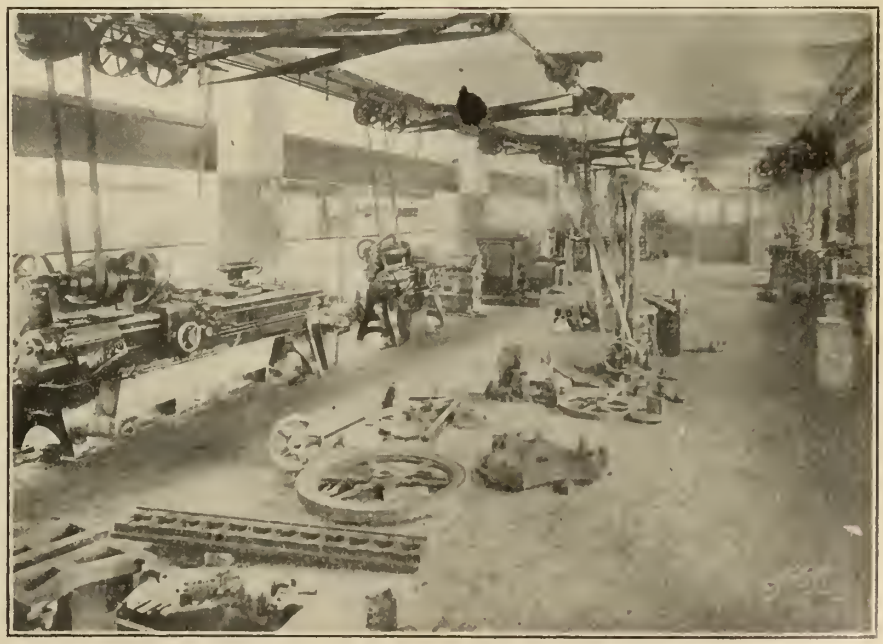

FIG. 5—Fairbanks-Morse Canadian Mfg. Plant—The Tool Room.

make this one otherwise than unique. It is of great interest to witness the operation of these gas plants in actual practice, and having done this one will realize more fully than he probably has before, what an important part the producer gas engine and the producer plant are to play in the field of prime movers. An interesting feature about the power plant itself is the fact that the complete equipment, from the producers to the dynamos, is furnished by one firm, the Fairbanks-Morse Co. A view of the complete plant is shown in Fig. 7, although only a glimpse of one of the producers can be obtained through the doorway.

FIG 6—Fairbanks-Morse Canadian Mfg. Plant—View of the Foundry.

The plant consists of two 150 h.p. suction producers supplying gas for the two 150 h.p. vertical, throttling, electric lighting gas engines shown in the view, and four dynamos, two run from each engine. Provision has been made for the addition of another producer and engine and two more dynamos.

A record of the coal consumption of this plant will probably be the most interesting feature to the power user, and perhaps the results obtained may surprise many. It is estimated that the coal consumption has averaged one pound of pea anthracite per brake horse power, which is one quarter pound better than the Fairbanks-Morse Co. guarantee their plants to operate upon, and at the market price of anthracite coal it is estimated that the average cost per brake horse power-year is $8.50. To all appearances the producers give absolutely no trouble, the only thing being to keep them supplied with coal and to poke the fire with a long poker through the top of the producer after each fresh supply of coal. In this plant this is done every half hour or so.

The power house is also equipped with two steam boilers used for heating the building, and there is, too, an air compressor, operated by an electric motor, supplying air for the pneumatic hoists in the foundry, and for the hammer in the forge shop.

A feature of this power house is the spacious coal bins, which are built entirely of concrete.

Offices and Drafting Room.

In one corner of the machine shop building are the offices and drafting rooms, which are commodious and comfortable. The time clock, supplied by W. A. Woods, Montreal, is situated just outside of the office door leading into the machine shop.

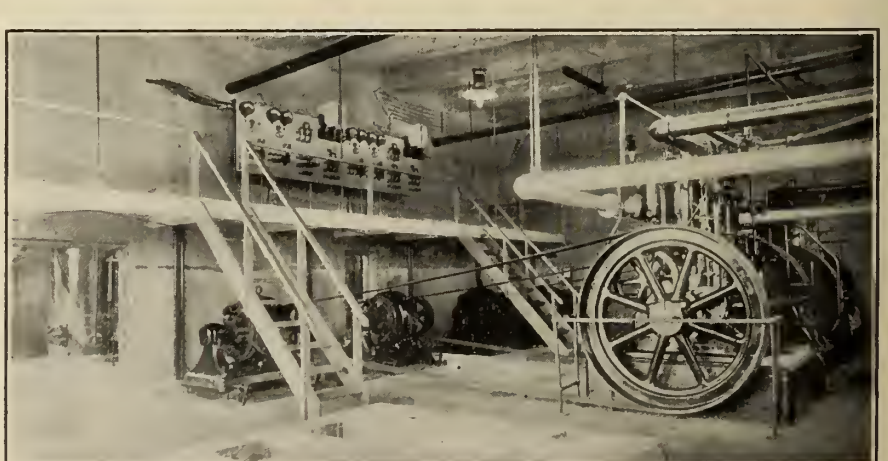

FIG. 7—Fairbanks-Morse Canadian Mfg. Plant—The Power House.

In this plant Canada has one more industry of which she might well be proud, and its establishment here is further evidence of the general industrial expansion of Canada at the present time.

FACTORY CONSTRUCTION.

In the construction of a factory at the present day, perhaps more than ever before, simplicity should be the one great feature, and this should be found not only in the arrangement of the machinery, but all through, from the time the lumber leaves the pile or kiln until it is loaded into the car. Life is too short and competition too keen to handle the product twice if once will do; besides, the extra handling does not usually improve the stock. The initial cost is not the only thing to be looked at in constructing and equipping a factory. The whole system of working is the main thing to be carefully systematized, and the proper time to do this systematizing is when the plant is being designed. Economy is a good thing, but it should be used only in its proper place. It should under no consideration be employed to the extent that we use a lot of unsuitable machinery just because we can save money on the initial cost. Put in the machinery that will give best results with the least cost for maintenance and operation. Have everything proportioned, but it is always well to figure on a little surplus power. Have everything strong, then keep it running. —The Woodworker.

Inquisitive French Bishop to Duke de Roquelaire, passing in haste through Lyons: "Hi! hi! Where have you come from?" "Paris." "What is there fresh in Paris?" "Green peas." "But what were the people saying when you left?" "Vespers." "Goodness, man, who are you? What are you called?" "Ignorant people call me Hi! Hi! Gentlemen term me Duke de Roquelaire. Postillion, drive on!"

*Gas Engines in Commercial Service**

By J. R. Bibbins

Gas vs. Steam.

TO obtain a full appreciation of the point at issue it is necessary to "figure back" from engine shaft to coal pile, taking a broad survey of the complete plant as a means for converting thermal energy into useful work.

In the chart, Fig. 1, the writer has attempted to make an approximate distribution of losses in various parts of the plant, based upon observations from numerous sources on each of its component parts. It is believed that the estimates are not unduly partial to either a gas or steam plant of moderate size. In every large and highly equipped plant the net efficiency would presumably be higher.

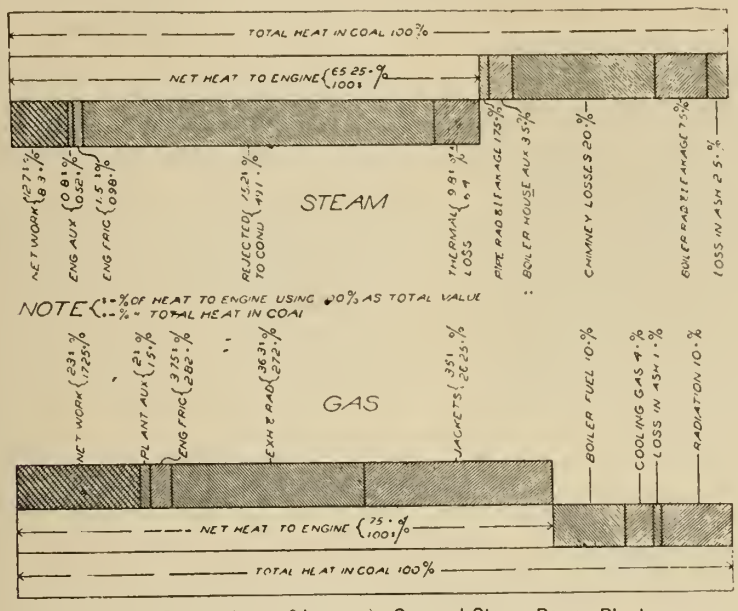

FIG. 1—Comparison of Losses in Gas and Steam Power Plants.

Starting with the heat in a fair grade of steam coal, 13,500 B.Th.U. per pound, we find 35 per cent. of this heat dissipated in the boiler plant and piping system, and 25 per cent. in the producer plant; 57 per cent. is, however, dissipated in a steam engine and approximately the same in the gas engine, leaving 8.33 per cent. net output for the steam plant and 17.25 per cent. for the gas plant. Thus, on a heat basis, gas is twice as efficient as steam.

Part of the advantage lies in the more efficient converting properties of the producer and the remainder in the higher thermal efficiency of the gas engine. In natural gas plants, where no producers are necessary, there is, of course, no question as to the superior economy of gas. An 800-h.p. gas central station at Bradford, Pa., several years ago, replaced steam power by a gas engine plant, the change resulting in an immediate reduction of gas consumption from 86 cu. ft. per kilowatt hour to 21.5 cu. ft., or 75 per cent.

Granted the superior economy of the gas plant, it does not always follow that the ultimate cost of power is reduced in exactly the same proportion, for it is necessary to take into account not only operating costs, but also investment costs or fixed charges to arrive at a proper conclusion. Without going into this economic problem here it is sufficient to say that plants of a few hundred kilowatt capacity may quite possibly cost more per kilowatt than a steam plant of corresponding size and character, but the saving in the operating expenses will soon wipe out the extra cost and eventually put steam "out of the running."

Power Plant Duty.

Two gas plants afford a good proof of the above conclusions. One is a small producer-gas power plant in industrial works service, less than 500 k.w. capacity. It uses a fair grade of bituminous coal costing $2.30 per ton, and gives 24 hours' service on a widely fluctuating load. The data includes all the coal used for the making of new fires and for all standby losses during Sundays and holidays. Operating on a station-load of from 50 per cent. to 75 per cent. the coal consumption is but little over 2 lbs. per kilowatt hour — certainly a remarkable economy for so small a plant. At 20 per cent. load factor 2.9 lbs. of coal and 80 per cent. load factor 1.9 lbs. per kilowatt hour is required.

Again, Fig. 2 summarizes the economic results of numerous tests of the St. Louis Fuel Testing Laboratory. These tests varied from 15 hours to 30 hours in duration, and included many grades of fuel from the poorest western lignites to the richest West Virginia bituminous coals. With a plant of only 175 h.p. capacity and of the belted type, the local consumption averaged between 2 lbs. and 2.25 lbs. per kilowatt hour within the ordinary range of steam coals. But observe that with the lignites, running as low as 6,500 B.T.U. per pound, the coal consumption has scarcely doubled. It would manifestly be impossible to run a steam boiler efficiently on such poor fuels, but the producer seems to be able to efficiently

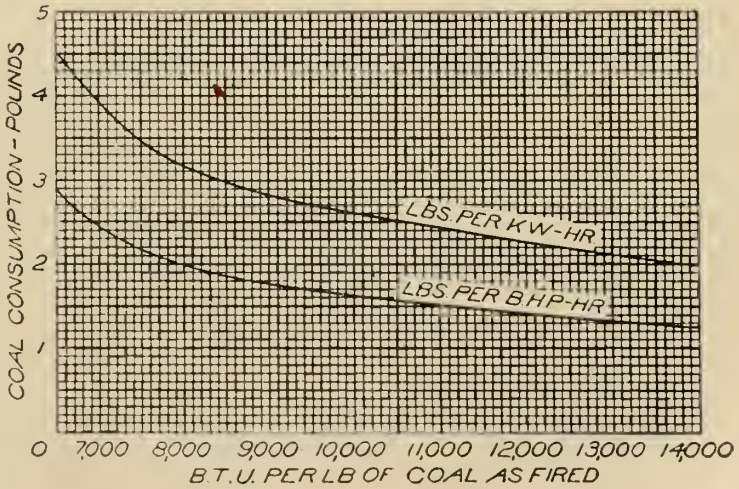

FIG. 2—Coal Consumption Curves for Producer Gas Plant in the St. Louis Testing Laboratory.

* Paper read before the Ohio Society of Electric and Steam Engineers.

gasify the poor fuels almost as well as the rich.

The Gas Engine in Service.

Granted again the superior economy of the gas power plant, there still remains the question of its ability to sustain the fluctuating loads and hard service required of a modern prime mover. The best answer to this question is a glance at the results that have been obtained in numerous plants both in this country and abroad.

Is the gas engine limited in its general application? Unqualifiedly, no! Within less than a day's ride of Pittsburg, gas engines may be found operating side by side with or in place of steam engines in almost every modern industry where power is used. In Pittsburg alone you may find gas engine plants of from 100 h.p. to 2,200 h.p. In industrial works service alone twenty plants are at work, representing some of the most conservative commercial organizations in the country, such as the Carnegie Steel Co., American Bridge Co., American Sheet & Tin Plate Co., McClintic-Marshall Construction Co., Riter-Conley Mfg. Co., and the four Westinghouse Companies.

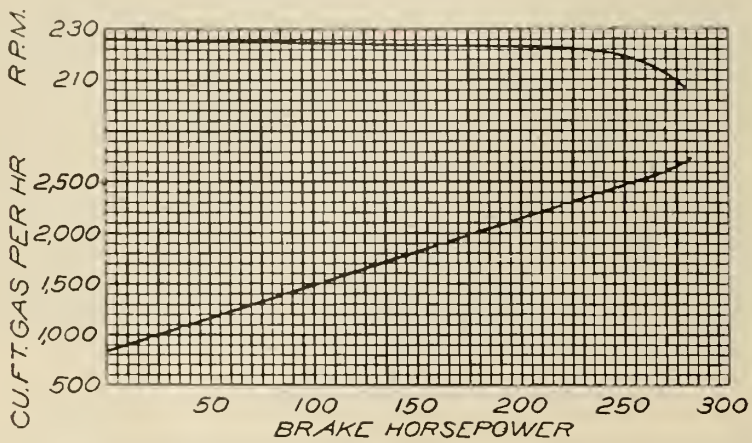

FIG. 3—Speed Regulation and Total Fuel Consumption of Typical Gas Engine.

Regulation.

Taking up now some specific points; probably more uncertainty exists as to the ability of the gas engine to drive electrical machinery, particularly alternation-current machinery, than regarding any other question in its application. Here again we may turn to field practice for light. Of the twenty Pittsburg plants mentioned above, the majority are operating electrical machinery, and in most cases, direct connected. Moreover, about half of this number are driving alternating-current generators in parallel upon a common bus bar. And it must be remembered that the service which these plants are doing in furnishing industrial power is more of a test of their running qualities than would occur in any electric lighting plant where the load increases and decreases gradually.

Most of these engines are of the three-cylinder single-acting type, and an analysis of the crank effort shows a resultant, so much more uniform than in the case of a single-cylinder engine that parallel operation becomes feasible where the single cylinder would be absolutely out of the question.

Most of the prejudice against gas engine regulation arises from acquaintance with small single-cylinder machines running on the "hit or miss" principle. This system has long since been absolutely displaced by the simple throttling system for electric work; in fact, any system, where the impulses are uniform, will give fairly desirable results. In the throttling method of regulation, the quantity of gaseous mixture delivered to the cylinder is directly proportioned by the governor to the load on the engine, but the quality of this mixture, i.e., the proportion of air to gas, is maintained quite constant for all loads.

Diametrically opposed to this method is the "impoverishing" system in which the gaseous mixture is weakened, i.e., as the load becomes lighter less gas is introduced. It has the disadvantage that the efficiency of combustion falls off rapidly on all loads except that at which the proportion of gas and air is just right for perfect combustion. Furthermore, on light loads the impoverished mixture becomes so weak that ignition is not always certain, as is clearly shown by experiment, a diminution of 5 per cent. in the gas results in a loss of over 20 per cent. in pressure. On the other hand, the throttling system is somewhat handicapped on light loads by the effect of the pump work which the engine must do to supply itself with the mixture, this work appearing as a negative quantity in the indicator diagram. Above half load, however, this pump work is of little importance, and full load can scarcely be detected on the card.

Regulation is much affected by the time lag of the gaseous mixture in reaching the cylinder. It must be remembered that every cubic inch of mixture that passes the governor valve must do work in the engine before the speed is again under governor control. Hence long passages of considerable cross-section between governor valve and cylinder tend to reduce the fineness of regulation. Manifestly, in multi-cylinder engines the ideal point for effective governor control is right at the admission valve, and in fact this idea has been carried out in a number of types of horizontal engines, such as the Westinghouse. Each end of each cylinder is independently controlled from the governor, and the functions of both admission and mixing valves are combined in a single valve of simple construction.

Another important principle in securing sensitive regulation is that the actual work of moving heavy valves should not be imposed upon the regulator itself. In the double-acting engine above mentioned, a relay type of control has been adopted with demonstrated success. A continuous enclosed oil pressure system, operating under 40 lbs. to 60 lbs. per square inch, does the actual work of valve movement by means of a double-acting oil cylinder. The control of this cylinder is vested in a small pilot valve actuated directly from the regulator. Thus the friction load upon the regulator is negligible, and, at the same time, comparatively unlimited power is instantly available

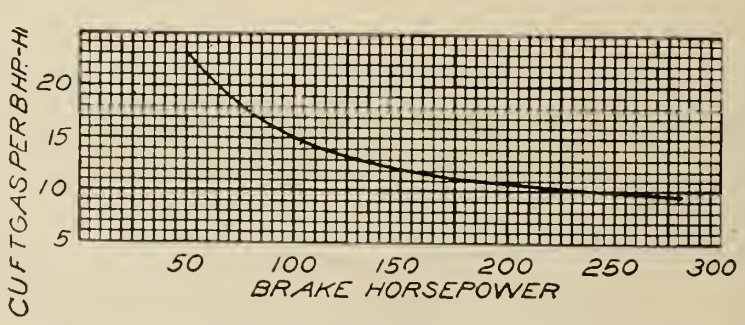

FIG. 4—Variation of Gas Consumption with Load.

at the main valves with the slightest change in speed.

This whole question of regulation may be best appreciated from actual speed, load and voltage records, taken simultaneously. It is one thing to tell you that on gas engines we obtain a speed variation of from 2 per cent. to 3 per cent. from no load to full load, and on horizontal tandem engines a still closer degree of regulation; but it is another to observe this for ourselves from actual records. Figs 3 to 6 give a resume of a typical test on a three-cylinder, single-acting gas engine taken at random from our records of over 1,000 gas engine tests. The speed curve, Fig. 3, shows a variation of 0.7 per cent. at half load, 1.4 per cent. at full load, and 2.7 per cent. at 18 per cent. overload; with still greater overload the engine began to slow down.

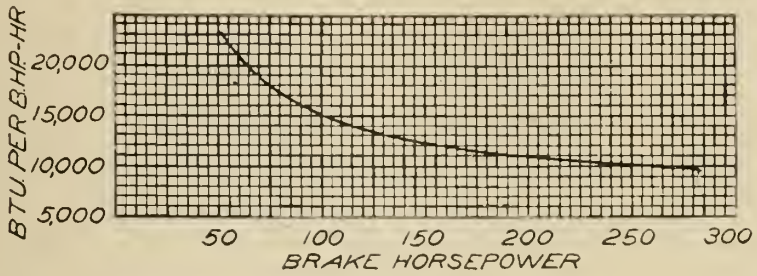

FIG. 5—Heat Consumption and Load.

An interesting case of mistaken prejudice against gas engine regulation occurred in an English spinning mill where a gas engine was installed to replace a steam engine. The former was a vertical two-cylinder double-acting engine, and the latter a horizontal tandem compound. The officials at first were very dubious about the ability of the gas engine to give sufficiently close regulation for spinning work. By tachograph records taken first on the steam engine, and later on the gas engine, showed a total cyclical variation of over 8 per cent. for the steam engine, and about 0.2 of 1 per cent. for the gas engine.

Maintenance.

A favorite argument of the steam engine enthusiast is that the cost of keeping a gas engine plant in repair is so enormous as to nullify the advantages accruing from its higher inherent efficiency. It is hard to offer rebuttal to statements of this kind because disparaging data is always available to those who have a purpose in view. It is only necessary to say that when maintenance cost is excessive we may look for faulty operation or design of the plant.

Results from the Bradford central station are apropos at this point. The plant which aggregates 800 b.h.p., with five belted units, is in its eighth year of service, yet the average cost of repairs on gas engines exclusively for the last two years was $92.70 per annum, which is equivalent to 11.6c. per horsepower year, or 0.0125c. per kilowatt-hour generated.

For service averaging 18 hours a day, it is found necessary to inspect the engines only once in twelve months. At each inspection, a set of piston rings is replaced by new ones, whether worn out or not. The present exhaust valves average one year's work without regrinding, and even then are not in bad condition. Some valves have run over fifteen months. Admission valves require practically no attention. Igniters average about nine months without repointing.

In the 2,000-kilowatt central station at Walthamstow, London, the annual expenses for repairs and renewals during 1904 averaged 0.065c. per kilowatt-hour generated, including repairs not only to gas engines, but also to producers, electrical machinery, switchboards, batteries, distribution system, and consumers' meters.

It will be of interest to know of a record run made in the State of Ohio by a 650-h.p. Westinghouse gas engine, which has been at work for several years compressing gas for long-distance distribution. Owing to a break down in another part of this plant this engine was compelled to run under maximum gas load continuously, day, night and Sundays, for forty days without shutting down. During this period not a mishap of any kind occurred, and upon examination of the engine at the end of the run no repairs were necessary.

Cost of Power.

Out of the several items constituting the operating cost of power, viz., fuel, labor, supplies and repairs, fuel is, of course, the most important, and it is worth while pointing out here how easily one may be fooled in making comparisons between steam plants and gas plants. In a high-grade steam plant, the cost of coal usually runs from 55 per cent. to 60 per cent. of the total cost. This leaves about 20 per cent. for labor, the same amount for repairs, and the balance for supplies. In a producer-gas plant on the other hand, the fuel item is proportionately smaller, in fact from 35 per cent. to 45 per cent. of the total operating cost. This necessarily places a larger per cent. of the costs upon the remaining items. Hence in comparing the distribution of costs between steam and gas stations it may readily occur that the latter shows a higher percentage in cost of labor, supplies, or repairs, whereas it is relatively superior in these respects.

Quoting actual figures, the operating costs of the 800-h.p. Bradford station, including heating of buildings, with the price of gas ranging from 12c. to 17c. per 1,000 cubic feet, and a station-load factor of less than 20 per cent., ranged between 0.8 and 0.9 cent per kilowatt-hour metered at the switchboard. The distribution of expenses averaged as follows: Fuel, 42.8 per cent.; labor, 43.7 per cent.; supplies, 8.0 per cent.; total repairs, 5.6 per cent., of which the repairs of the gas engine alone was 1.4 per cent. This plant is not particularly efficient. The machinery, with a single exception, is all old style and belted, but the station is run with care, and intelligent attention is given when it is needed, which in part accounts for the low cost of repairs.

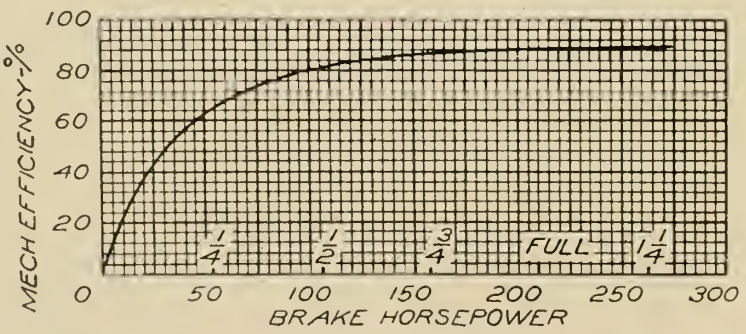

FIG. 6—Efficiency and Load.

That country is the richest which nourishes the greatest number of noble and happy human beings; that man is richest who, having perfected the functions of his own life to the utmost, has also the widest helpful influence, both personal and by means of his possessions, over the lives of others.—Ruskin.

CANADIAN MACHINERY
and Manufacturing News

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CONTENTS

Modern Canadian Manufacturing Plants - - - 363
Fairbanks-Morse Canadian Manufacturing Plant.
Gas Engines in Commercial Service - - - - 367
By J. R. Bibbins.
Editorial - - - - - - - - - - - 370
Canadian Manufacturers' Convention - - - 372
About Catalogues - - - - - - - - 374
Milling Cutters: Their Uses and Abuses - - - 375
By John Edgar.
Zinc and Its Manufacture - - - - - - 377
Tricks of the Trade - - - - - - - - 378
Three-inch Pump Valve Tools.
System of Keeping Tools.
Wait But Work.
The Wastefulness of Chimney Draft.
Mechanical Reviews - - - - - - - - 380
An Improved Planer Drive.
Cast Iron Gauges.
The Use of Nail Cores.
Gas Turbines.
Practical Questions and Answers - - - - - 382
Foundry Practice - - - - - - - - 383
Multiple Moulds.
Foundry Costs.
Producer Gas: Its Production and Application - - 386
By Emil Stern.
Machinery Development - - - - - - - 388
A New Inside Moulder.
New Style of Headstock.
New Style of Gauge Tests.
A Blast Fan of Unusual Proportions.
A New Radial Drill and Tapping Machine.
Canadian National Exhibition - - - - - - 391
Power and Transmission - - - - - - - 398
Allis-Chalmers Blowing Engines.
The Imperial Engine.
Miller Reversible Gas Engine.
Additions to Ottawa Electric Lighting Plant.
New Electric Railways.
Industrial Progress - - - - - - - - 400
Personal Mention - - - - - - - - - 63

SEPTEMBER METAL FEATURES.

ALTHOUGH the market of early September was calm and remained stationary for a much longer time than usual, the closing days of the month have contained sufficient excitement to make up. Many lines, both in ingot and sheet metals, are now commanding higher prices than they were a month ago, while it may be safely said that from pig iron to tin every commercial metal has improved in tone during September.

Copper has been advancing right along in primary market, and, although Canadian jobbers have made no change in their quotations, it is hard to see how they can long continue existing prices. Antimony has gone up about half a cent, and tin is firmer than has been the case for some time past. Zinc spelter has been affected here by a steady advance in Old Country markets, and higher prices are now being quoted. Pig iron, as is well known, has experienced a demand which has more than taxed the capacity of furnaces, both on this continent and in Great Britain. Nearly all the producing plants are booked for several months ahead, and many popular grades have been temporarily withdrawn from the Canadian market. Foundrymen and other consumers of pig iron have been so impatient for deliveries that importers who had stocks on hand were able to obtain stiff figures. But it has remained for pig lead to cap the climax. Prices are now fully 25 cents per hundred pounds higher than at the first of the month. In fact, not since 1888 has such a condition existed. More than that, it is almost out of the question to obtain prompt deliveries on any large quantities. All lines of sheet metals are active. Galvanized sheets have been advanced by manufacturers and importers, and booking for forward delivery in the Spring is very heavy. Sheet lead and sheet zinc have gone up, in sympathy with pig lead and spelter respectively, and tin plates have also advanced in primary markets. A shortage in galvanized Canada plates is being keenly felt. One of the leading interests in the country has informed us that not a box of these goods has been placed in their warehouse for weeks, most of their importations being snapped up even before reaching this country.

It is a long time since strength and firmness have been so generally felt on the metal market, and from all appearances quotations are bound to go much higher yet in several lines.

TECHNICAL EDUCATION.

IT has undoubtedly been a good move on the part of the Canadian Manufacturers' Association to take up the question of technical education. The rapid growth of Canada industrially necessitates that there be a more adequate means for the education of Canadian engineers and mechanics technically than at present exists; and the action taken by the association is a step in the right direction. The industrial development of a country depends very largely upon the skill of its engineers and mechanics, and the experience of Germany and other prominent industrial countries has proved that it pays to provide means of increasing and developing this skill. The technical education committee, at the recent convention in Winnipeg, reported that the Government will take favorable action along this line early in the coming session. So far, so good. But while the Manufacturers' Association as a body are considering the question, the individual manufacturer should not think himself relieved of all responsibility; he is not, because individual effort is required as well as combined effort. It is to the advantage

of each manufacturer to have his employes as skilled as possible in their respective trades or duties ; and he can take steps towards this end with very little trouble or expense to himself, and in so doing he would at the same time be advancing the general interests of technical education. A well known automobile manufacturing firm allow their designers and draftsmen an hour each day in a reading room provided with practically all the technical automobile periodicals published, as well as a small library of books relating to automobiling. No doubt this is a paying investment for this firm, and similar practices might well be adopted more generally. Even should a manufacturer not feel justified in such an investment of his employes' time, he might at least provide a small library of books and periodicals for reference purposes without any fear of the investment not being a remunerative one. Undoubtedly those concerned in the designing and those superintending the manufacture of the product would receive much benefit from such a library, which benefit of a necessity would be reflected to the manufacturer. Then, too, the mechanics in a plant should not be overlooked, and it would appear a feasible scheme to allow them access to a reading room during noon hour, where might be found copies of mechanical trade journals and a few copies of standard works on subjects in which their work would lead the men to be most interested. The happy results of such a scheme would be two-fold, namely, profitable employment during noon hour would be provided and at the same time the ambitious mechanic would be led to take a greater interest in reading than the average at present does. Such a scheme would certainly be advancing the interests of technical education, and would also be worth the investment to the manufacturer.

A NEW MACHINERY HALL AT THE EXHIBITION.

IN this issue we have devoted considerable space to the Canadian National Exhibition, taking up the discussion of the necessity of building a new and up-to-date Machinery Hall. We publish opinions given by a number of manufacturers and machinery dealers on this question, but owing to lack of time we were not able to make this as complete as we would have wished. In view of this we will be very pleased to have any of our readers send in a statement of their views on this question, especially if they have any suggestions as regards the size and style of a suitable building, which we will publish in our next issue.

DESCRIBING NEW MACHINES.

NO trade paper can be a force in its field if its editorial policy is influenced by its advertising campaigns. The only reliable policy is to build a paper for its readers, else it will not be read, and will be of no use to advertisers. That spells ruin sooner or later. But a paper should not be misjudged by its readers, which is done at times. There are those who object to the illustrating and describing of new machines in a mechanical paper because of the advertisement to the manufacturer. There is no ground for such an objection, that is if the new features of the machine are of sufficient interest to the readers to warrant the use of the space such a description occupies. To a manufacturer the description of a new machine or mechanical appliance is of interest because it may be a factor in the reduction of manufacturing costs ; and to a mechanic it is of interest because the more he knows of up-to-date machines the greater will be his wage-earning capacity. But it must be confessed that there may be a tendency to deprave this department for advertising purposes, but if this is done it will leave its mark on the department, which cannot long escape notice. Then an injustice is being done the readers, and they have a legitimate right to object, but not until then.

SERIES OF ARTICLES ON PRODUCER GAS.

WE would direct the attention of our readers to the first of a series of articles which is appearing in this month's issue on "Producer Gas : Its Production and Application," being prepared for Canadian Machinery by Mr. Emil Stern, consulting and installing engineer for the Economic Power, Light & Heat Supply Co. Mr. Stern has very recently come to Canada from Germany, where he has been in close touch with producer gas plants and gas engines for some time, having latterly been associated with the firm making the Pintsch producer. This series of articles will include an historical sketch of the producer gas plant, a description of the various up-to-date plants made by prominent German, English, French, and American builders, and an article devoted to hints as to the running of a producer plant. Should this series prove of sufficient interest to our readers it will be continued, producer gas engines, their development and methods of present day manufacture, being considered.

MANUFACTURING PLANT TO SUPERSEDE WAREHOUSE.

THE Canadian Northwest is regarded as a grain-producing and cattle-raising section, and up to the present her needs in the way of manufactured goods have been supplied from Eastern Canada and the United States, consequently the cities of the west have been warehouse and distributing centres and not manufacturing centres. However, within the last year or so the west has started to manufacture for herself, and in this respect a very significant statement has been made by C. C. Ballantyne, president of the Canadian Manufacturers' Association, after a recent trip to Winnipeg. He said :

"The warehouse period in Western Canada will soon be a thing of the past. Factories are being erected and more sites for manufacturing concerns are being secured. It is only a matter of time before the west will make the greater part of her own goods."

Quite recently several eastern manufacturers have been negotiating with a view to starting manufacturing plants in Winnipeg, and also American firms. Of course the chief object of manufacturing in the west is to save freight rates from the east and extensive warehouse expenses, and although there are difficulties to be overcome in manufacturing in the west which are not so apparent in the east, the policy of some of the manufacturers in regard to establishing plants in the west seems to indicate an advantage.

The cost of power is an important consideration in the establishing of a good many industries, and the prospected hydro-electric power development in the vicinity of Winnipeg will be a drawing card for that city. Then, too, the tapping of natural gas at Medicine Hat will provide a cheap source of power for that municipality, and the citizens have great hopes of making an industrial centre of their town.

Canadian Manufacturers Convention'

THERE gathered at Winnipeg over 300 members of the Canadian Manufacturers' Association to attend the thirty-fifth annual convention which has been this year for a second time held in that city. The convention was opened with the usual addresses of welcome, which were ably responded to; after which the president, C. C. Ballantyne, delivered his presidential address in a forceful but pleasing manner. The convention being over a large number of the delegates are making a hurried trip through the western provinces.

President Ballantyne's Address.

Mr. Ballantyne opened with a reference to the large and satisfactory increase in Canada's foreign trade. The total trade was $73,046,000 in excess of 1904-05, the exports increasing $53,270,000 or some $20,000,000 more than the imports. A gratifying feature was that the imports of British goods had increased more proportionately than imports from the United States. The speaker attributed the exodus of young Canadians to the States to the lack of towns and factories, and the inducements and opportunities they afforded.

"To-day the situation is completely changed," he continued. "We have begun to study our own resources. What do we find? Not only that nature had fitted us to be a great agricultural nation, but that our mines, our forests, our streams and our waterfalls destine us to stand in the front rank of the manufacturing countries of the world; that here, within our own borders, we have all the raw materials for the world's great industries, the necessary industrial opportunities for all our sons and daughters, and the greatest and best market for the products of our farms. Our neighbors to the south have recognized this even sooner than we ourselves. To-day they are returning to us our own.

"It is for us to say whether we will continue to purchase our manufactured goods in the United States, or put just a little more tariff on certain lines, and make the factories in the States build plants in Winnipeg, Saskatoon, Moose Jaw, Calgary, Medicine Hat, Regina, Edmonton or any other of the many centres in our great western prairies which have advantages to offer, and by this means keep the population we are getting. Last year our dutiable imports from the United States amounted to $94,200,167, the large percentage of which was manufactured goods, and might just as well have been made in Canada. As it is, the United States farmers, workmen, manufacturers and other citizens have just that much of our money that should have been kept at home.

The Fiscal Policy.

"It must be a matter of gratification to all patriotic Canadians that the fiscal policy has ceased to be a matter of partisan controversy. The leading politicians of both political parties now recognize the necessity of protecting Canadian industries of all kinds, and we may hope that when the members of our Dominion Parliament are called together in November to consider the revision of the tariff they will set aside all old prejudices and look at the question from the broad standpoint of Canadian interests, that they will consider what policy will best develop the varied resources of our country, give profitable employment to all classes of our people, and maintnin and advance the prosperity that now exists.

C. C. BALLANTYNE, of the Sherwin-Williams Co., Montreal, Retiring President of the Canadian Manufacturers' Association.

"We are sometimes asked what we mean when we say Canadian manufacturers do not demand a prohibitive tariff against the United Kingdom, but that we must at least have sufficient protection to put our Canadian manufacturers on an equivalent footing with those of Great Britain. Perhaps our meaning may be better understood when I cite the case of one of the members of our association who had large factories in Montreal and London, England. The difference in the wages paid in these two great factories of England and Canada is remarkable. Figures taken from the pay rolls, and strictly accurate, show that common labor is 82 per cent. higher in Canada than in England, gang leader or sub-foreman 70 per cent. higher, boys (16 to 18) 85 per cent. higher, machinists 64 per cent. higher, carpenters 40 per cent. higher, girls (by the hour) 33 1-3 per cent. higher, and girls (piece work) 66 2-3 per cent. higher.

"Are not these figures alone sufficient to show the necessity of maintaining an equalizing tariff against British goods? But if, while giving our manufacturers fair play in competition with British manufacturers, we make our tariff so high against all foreign countries that our surplus requirements, above what our own factories can supply, will be obtained from British manufacturers, a vast amount of money which now goes to enrich foreign nations will be turned into the pockets of British manufacturers and their workingmen."

Western Possibilities.

Mr. Ballantyne referred to a memorial presented by the Medicine Hat Board of Trade to the Dominion Tariff Commission to the effect that if the tariff were high enough to shut out the great influx of American goods, many United States manufacturers would start branch factories in Medicine Hat. The latter would not be the only town in the west to benefit by this policy. The possibilities of Winnipeg it would be difficult to exaggerate.

"To accomplish this," the president proceeded, "we want a strong Canadian policy that will benefit both east and west. What action the Government will take at the coming session of Parliament we cannot say, but we believe that the Government will give us the best and strongest Canadian tariff that we have ever had, and one that will give thorough protection to every Canadian industry."

Flaxseed was referred to as an article of great importance to the farmers of the west, but owing to its being on the free list was not produced to any great extent. The United States farmer pro-

duced 29,000,000 bushels of flaxseed during the last fiscal year, compared to a little over half a million bushels in Manitoba and the Northwest Territories, which are better adapted for its growth than any country in the world. Canadian flaxseed was shut out of the American market on account of a duty of 25 cents per bushel. Under these circumstances he asked: "Why do not our Canadian farmers ask our Government to place a duty on flax entering Canada and thus give them the home market which they are justly entitled to? There is from a million and a half to two million bushels of flaxseed consumed in Canada annually by our Canadian linseed oil crushers, and why should a million bushels or more of foreign seed be used instead of buying 'Grown in Canada' flaxseed, and grown right here in the west, the best that can be produced?

Canada's Varied Resources.

"Resources of every kind are at our hand. The mines, the forests, the seas, the farms and factories of Canada are all beckoning labor and enterprise from every part of the globe, offering not only healthy conditions and comfortable homes, but a citizenship which, in the freedom of its thought and institutions, is as broad and free as our great dominions themselves.

"Great as these resources are, they are all enhanced by our splendid position in the empire and the world of commerce. Nature has destined us to be a great producing country. Let us not forget that we possess the shortest routes to Great Britain on the east and the Orient on the west. We lie between the east and the west. We hold the strategic position in time of war, and we will hold the commercial supremacy in the time of peace. In the great Imperial preferential movement to which we are moving on, and in the commerce of the world, Canada must play an important part, and the life of this great association must be woven into her development from year to year.

"What a great task; what greater opportunities! To develop all our industries hand in hand, to cultivate and maintain a national co-operation between our now scattered provinces, to weld and strengthen the bonds which bind us to the other portions of the Empire, and all the while to keep pure and healthful our moral and political life. If we are faithful to the trust imposed in us we need have no fear of the future."

Mutual Insurance Endorsed.

The mutual insurance committee's report was particularly interesting. The action taken in adopting it and choosing provisional directors for the two companies to be organized was probably the most important work of the whole convention.

"It is almost impossible," the report said, "to present a statement that will convey an intelligible appreciation of the results of the work thus outlined, so much of it being intangible and difficult to place under any given heading, but in so far as a record is possible it may be thus summarized:

"(1) 146 insurances arranged and new schedules printed.

"(2) Direct annual saving in insurance premiums of $17,904.91, through improving risks or rearranging business.

"If the facts point to any conclusion at all it is in emphasizing the belief prevalent amongst manufacturers in Canada that the losses sustained by them in recent years do not warrant the high rates they are charged. Statistics are not available to make this belief an absolute certainty; the fire insurance companies themselves are the only source from which such figures can possibly be obtained, and, as they have never yet supported the contention so often repeated that 'Your class of risk does not pay' by the production of any confirmatory evidence of actual results, we can only accept the best evidence obtainable and form our opinion and judgment accordingly."

The failures of negotiations with the Fire Underwriters for permission to place risks with independent companies was recorded, and the necessity of ceasing to do a brokerage business with tariff companies pointed out.

Two Mutual Companies.

The report then referred to the executive council deciding to establish two mutual companies for the underwriting of risks in the senior and junior mutuals and of sub-standard risks on the lines of companies forming the National Association of Factory Mutuals.

In reply to communications to members 301 return agreements duly signed promising definite support to the proposed companies in sums varying from $1,000 to $100,000.

Thirty-four write approving the formation of the companies, and promising full support when organized if conditions are satisfactory.

Seven write discouraging the formation of the proposed companies.

"The 301 members sending definite agreements promise an aggregate insurance in each of the two companies of $2,371,000, of which about $1,250,000 will be available at the outset. Adding support from the members who have written, but who have not signed definite agreements, it is quite apparent that the two proposed companies will have at inception a minimum available insurance of at least $1,500,000 in each company, or three times the sum upon which it was thought the companies might safely commence operations.

"The committee, therefore, recommended that this meeting approve the continuance of the insurance department under plans to be approved by the executive council from time to time, and that the finance committee be authorized to provide whatever deficiency may arise in the expenses over the revenue of the department under such limits and restrictions as it may deem advisable.

"The revenue of the department for the year has fallen short of the expenses of the same period by $873.19."

Changes in Law Wanted.

It was recommended that the association ask for a change in the Insurance Act of Canada, to provide for:

(1) The incorporation and licensing of mutual fire insurance companies.

(2) The adoption of a paid, definite, and invariable standard insurance policy, protecting both the interests of the insurer and insured.

(3) The rejection of the aggregate liability assumed by fire insurance companies in cities and towns, so that in the event of large conflagrations the amount of such aggregate liability may be within the resources of the company to discharge.

The membership of the association was reported at 2,104, as compared with 1,839 last year. Of this total 1,257 were in Ontario.

P. H. Burton was named as chairman of the Toronto company and J. H. Burland chairman of the Montreal company.

Election of Officers.

The election of officers resulted as follows: President, Mr. Harry Cockshutt, Brantford, (acclamation); vice-president, Hon. J. D. Rolland (acclamation). Provincial vice-presidents were elected as follows: Ontario, Lloyd Harris, Brantford; Quebec, J. A. Vandry, Quebec; British Columbia, John Hendrie; Manitoba, L. C. McIntyre; New Brunswick, Chas. J. Macdonald; Alberta, A. E. Cross, Calgary; Saskatchewan, E. J. Brooks, Regina.

The next place of meeting will probably be Vancouver.

Friendship, like everything else, is tested by results. If you want to know the value of any friendship, you must ask what it has done for you and what it has made for you.—James Stalker.

ABOUT CATALOGUES

By mentioning Canadian Machinery to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

Gas and Gasoline Engines.—Neat little catalogue issued by the Toronto Gas & Gasoline Engine Co., Dufferin street, Toronto, illustrating and describing their engines.

Alundum Grinding.—A leaflet issued by the Norton Emery Wheel Co., Worcester, Mass., describing "alundum," the material they are now using in the manufacture of their grinders.

Gisholt Lathes.—A sheet for the Gisholt Machine Co., Madison, Wis., reference book, illustrating and describing the 34-inch Gisholt turret lathe, specially designed for a railroad shop.

Armstrong Tool Holders.—The general catalogue and price list of Armstrong tool holders for all classes of work issued by Aikenhead Hardware, Limited, Toronto It is a neat size, 6 x 3 1-4 inches.

Canadian Lock Nut.—General catalogue of the Canadian Lock Nut Co., Limited, Pearl street, Toronto, illustrating and describing their locking nut. The work on the catalogue throughout is very fine.

Pumping Machinery.—Bulletin No. 4 of the Smart-Turner Machine Co., Limited, Hamilton, illustrating and describing their automatic feed pumps and receivers and their independent jet condensing apparatus.

No. 2 Plain Milling Machine.—Descriptions and specifications of No. 2 heavy plain milling machine, recently placed on the market by the Brown & Sharpe Mfg. Co., Providence, R.I. The catalogue is an exceptionally handsome one.

The Cushman Motor.—A booklet illustrating and describing the Cushman gasoline motors, marine and stationary, made by the Cushman Motor Co., Lincoln, Neb. The motors are very neatly illustrated and are described in detail.

The Jamestown Exposition.—A little booklet dealing with some features of the coming world's exposition to be held in Jamestown, Virginia, during 1907. It may be obtained by application to the exhibition authorities at Norfolk, Va.

Plain Milling Machine.—Catalogue of descriptions and specifications of No. 1 1-2 Brown & Sharpe plain milling machine, which is an addition to their line of plain milling machines, sent out by the Brown & Sharpe Mfg. Co., Providence, R.I. Size, 6 x 9 inches.

The Harris Patent Power Hoist.— A catalogue 6 x 9 inches, descriptive of the Harris patent power hoist and carrying machine, made in the United States by the C. S. Harris Co., Rome, N.Y., and which will be made in Canada by W. R. Perrin & Co., Toronto.

Bickford Radial Drills.—The 1906 radial drill catalogue of the Bickford Drill & Tool Co., Cincinnati, O. This catalogue is 6 x 9 inches and contains 41 pages. It is an exceptionally handsome catalogue, the illustrating and typographical work being of a very high order.

Nut Standards.—Bound specifications and drawings of the new standards for bolts, nuts and screws which have been adopted by the association of Licensed Automobile Manufacturers, 7 East Forty-Second street, New York. The matter is prepared in quite an elaborate style.

Lighting of Public Buildings—Is the title of a catalogue issued by the Westinghouse Co's publishing department, Pittsburg, illustrating and describing some installations of the Nernst lamp for the lighting of public buildings. The catalogue is 6 x 9 inches and is well illustrated.

The Hanna Riveter.—Catalogue No. 3. 1906, edition of the general catalogue of the Hanna Engineering Works, of Chicago, describing and illustrating different styles of the Hanna pneumatic riveter. The catalogue is gotten up in an original style, and is a handsome, well-illustrated one.

Expanded Metal.—An interesting paper published by the Associated Expanded Metal Companies telling of expanded metal concrete in the San Francisco disaster. The paper is profusely illustrated. A copy can be obtained from the Expanded Metal & Fireproofing Co., 100 King street west. Toronto.

Campbell Gas Engine.—A catalogue of the Campbell gas engines and suction gas producers gotten out by the Campbell Gas Engine Co., Limited, Halifax, England, illustrating and describing these engines and gas producers. A copy of this catalogue may be obtained from Wayland Williams & Dadson, 821 St. James street, Montreal, or from the Producer Gas Co., 11 Front street east, Toronto.

Sturtevant Economizer.—Bulletin No. 132, in the engineering series issued by the B. F. Sturtevant Co., Boston, Mass., illustrates and describes Sturtevant economizer installations in the power houses of the Interborough Rapid Transit Co., the New Orleans Railways Co., the Boston Elevated Railway Co., the South Covington and Cincinnati Street Railway Co., and the Burlington Municipal Electric Lighting Co.

BOOK REVIEWS.

The Management of Electrical Machinery.—This is a thoroughly revised and enlarged edition of "The Practical Management of Dynamos and Motors," by Francis D. Crocker, E.M., Ph.D., and Schuyler S. Wheeler, D.Sc., published by D. Van Nostrand Co., 23 Murray street, New York. Price $1.00. This book is 5 1-2 x 6 1-2 in. in size and contains 223 pages inclusive of the index. A complete revision of the former book was necessitated by the rapid progress of electrical engineering during the time since its publication. The arrangement and object of the matter in this edition is practically the same as that of the former edition, with the exception that a good deal of obselete matter has been eliminated.

An idea of the class of matter contained in this book is best understood from a review of its contents. It is divided into five parts, the first part deals with the selection and management of dynamo electric machinery including a review of the principles of generators and motors, installation of machines, foundations, and mechanical connections, the operation of generators, and the connections and operations of motors; part two deals with the inspecting and testing of the machines, including a consideration of adjustment, friction, balance, noise, heating and sparking, electrical resistance, voltage and current, speed and torque, and power and efficiency; part three deals with the localization and remedying of the numerous troubles which may be had with electrical machinery; part four takes up the consideration of constant current generators, including a description of the several types; part five deals with the management of railway motors.

To anyone having anything to do with the installing or operating of electrical machinery, this book should prove of exceptional value as a text book and also as a book of reference, because of the practical standpoint from which all problems are considered by the authors.

Milling Cutters: How They are Made, Used and Abused

By John Edgar

ARTICLE V.

MILLING cutters could not be treated in a complete manner without some mention being made of the special forms which have become commercial, in that they may be found in any well-kept stock, which has any pretentions of being complete. The very fact that it is possible to obtain on short notice such cutters make a description of them and their uses of great value to any who attempt to keep posted in milling machine practice.

In this article these cutters will be described and their use explained, bringing out points which may prove of value to users of them.

In the tool room use will be found for this class of cutters in the general run of work, as they are used in the production of tools peculiar to this department such as taps, reamers, drills, and other tools.

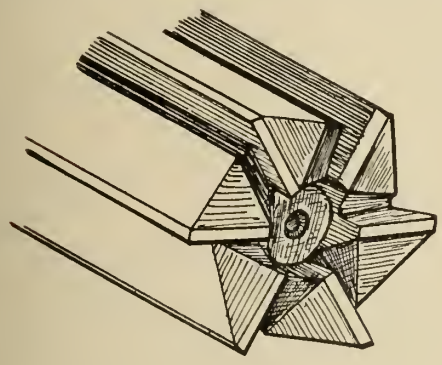


Fig 22.

"Centre Cut" End Mill.

A class of work that gives considerable trouble is that of milling slots from the solid metal, slots such as the drift-holes in collets or the roll grooves in cams. These slots are of such a nature and in such a position that it is impossible to mill them with the plane milling cutter, which cutter gives the best satisfaction wherever it can be used to advantage, but resource must be had here to the end mill, which when made in the ordinary manner does not act very well on account of its slow cutting properties and the clogging effect the chips have. Much better results are obtained by the use of the "centre cut" end mill, a sketch of which is shown in Figure 22. As will be seen, there is a large recess in the end of the mill, which allows the cutter to cut better when sunk into the work; but of course the depth of this sinking cut is limited to the depth of the recess. When the cutter is brought to the limiting depth it is fed along the work producing the slot to this depth, the

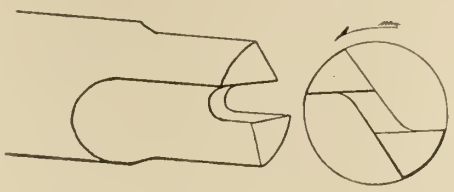


Fig 23

operation being repeated until the required depth of slot is obtained. These centre-cut end mills are also preferred by many for all work where an end mill can be used, and are undoubtedly better on cast iron on account of the much coarser teeth they have.

The "Cotter" Mill.

Another cutter that is much used and is preferred by many to the centre-cut end mill for milling slots, is that known as a "cotter" mill. This mill is illustrated in Fig. 23. It is used in the same manner as the one previously described. It has only two cutting teeth and these are given a very keen rake, which is of great value, since all the cutting is done by the end of the teeth. In sinking this cutter into the work there is produced a core which is removed when the cutter is fed along by the inner cutting edges of the teeth.

Gear Teeth Millers.

Probably the most familiar standard "formed" cutter is that for cutting the teeth of gears. These cutters are made according to two different systems of curves, the epicyclodial and the involute, the former being but little used in general machine work on account of the accuracy required in the preparation of the gear blanks and the centre distance of the shafts on which the gears are to be used. The latter has not these disadvantages, and the form obtained answers all the purposes of general practice. Gear cutters are also made to correspond to the two different styles of designating the pitch of the tooth, viz., the circular pitch and the diametral pitch. The circular pitch is used only is very rare cases where cut teeth are used, while the latter is almost universally used. Cutters made according to the metric system are numbered or designated as to pitch by the fraction

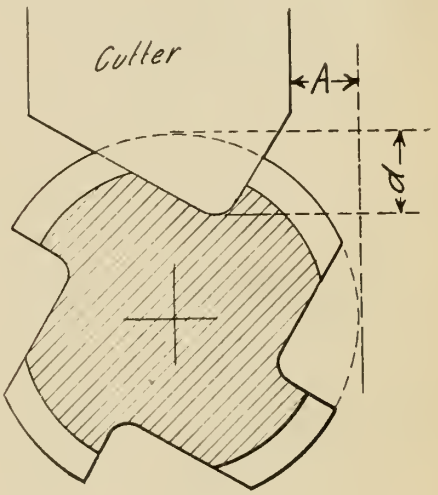


Fig 25

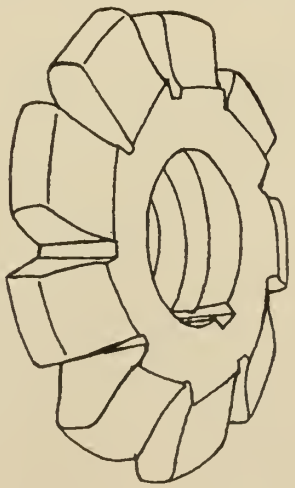


Fig 24.

produced by dividing the diameter in millimeters divided by the number of teeth. This fraction is called the "module."

Gear cutters are made in sets covering the range of wheels having from twelve teeth to the rack, and are ordinarily made with eight cutters to the set, ranging as shown in the following table:

Table V.

No. 1 cutter will cut wheels of 135 teeth to rack.
No. 2 cutter will cut wheels of 55 teeth to 134 teeth.
No. 3 cutter will cut wheels of 35 teeth to 54 teeth.
No. 4 cutter will cut wheels of 26 teeth to 34 teeth.
No. 5 cutter will cut wheels of 21 teeth to 25 teeth.
No. 6 cutter will cut wheels of 17 teeth to 20 teeth.
No. 7 cutter will cut wheels of 14 teeth to 16 teeth.
No. 8 cutter will cut wheels of 12 teeth to 13 teeth.

Some manufacturers are prepared to furnish cutters in half numbers, which still further reduce the range cut by any single cutter, but for general work the regular set of eight answers all the requirements of good practice. Figure

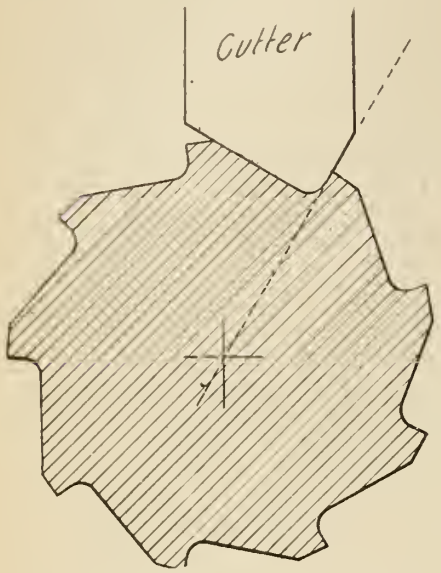


Fig. 26.

24 shows an illustration of one of these cutters.

Millers for Fluting Tops and Reamers.

A style of cutter for which there is much use in the tool room, is that used for fluting taps and reamers. Of these cutters there are several styles. Figure 25 shows the shape of a combination tap and reamer fluting cutter. Figure 26 shows the sectional view of

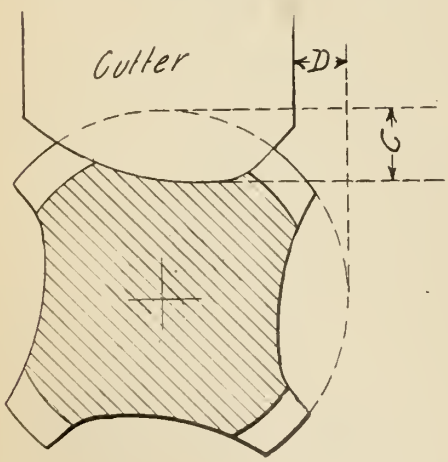


Fig 27

a reamer produced by this combination cutter, where comparatively few taps and reamers are made. This cutter will appeal to the buyer, as very good results are obtained at small expense. For use on taps, Brown & Sharpe give the figures shown in Table VI for the setting of the cutter relative to the blank. These cutters are made in sets of eight cutters, and are numbered numerically from 1 up, and take in a range of taps from ⅛ in. diameter to 2 in. diameter.

Table VI.

Data for setting combination tap and reamer cutters for fluting taps :

Dia. of tap.	No. of cutter.	A.	d.
1-8	1	0.000	0.028
5-32	2	0.000	0.035
3-16	2	0.000	0.043
7-32	2	0.015	0.050
1-4	2	0.031	0.057
9-32	3	0.015	0.065
5-16	3	0.031	0.072
3-8	3	0.062	0.086
7-16	4	0.031	0.100
1-2	4	0.062	0.115
9-16	4	0.093	0.129
5-8	4	0.125	0.144
11-16	5	0.093	0.158
3-4	5	0.125	0.172
13-16	5	0.156	0.187
7-8	5	0.187	0.200
15-16	6	0.125	0.215
1	6	0.156	0.230
1 1-16	6	0.187	0.245
1 1-8	6	0.218	0.258
1 3-16	6	0.250	0.273
1 1-4	6	0.281	0.287
1 5-16	7	0.218	0.300
1 3-8	7	0.250	0.316
1 7-16	7	0.281	0.330
1 1-2	7	0.312	0.345
1 9-16	7	0.344	0.359
1 5-8	7	0.375	0.373
1 11-16	8	0.312	0.388
1 3-4	8	0.344	0.400
1 7-8	8	0.406	0.430
2	8	0.468	0.460

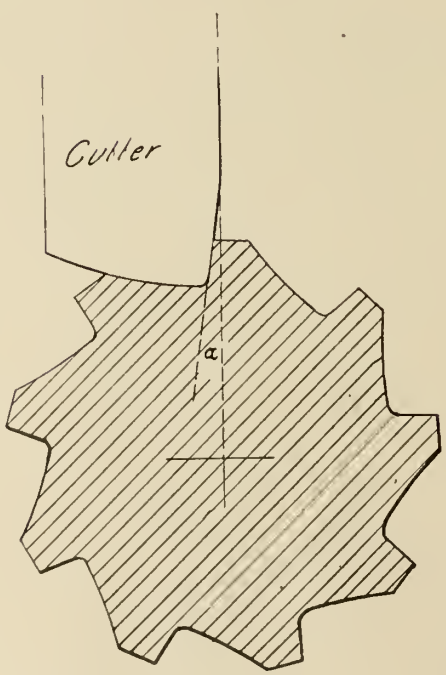


Fig. 28

In using the above figures it must be remembered that the tap must be cut with four flutes, as the data does not apply to any other number.

In cutting reamers it is left to the judgment as to the position of the cutter, it being possible to vary the number of teeth in the reamers; and the position of the fluting tool also determines whether the reamer has a clean

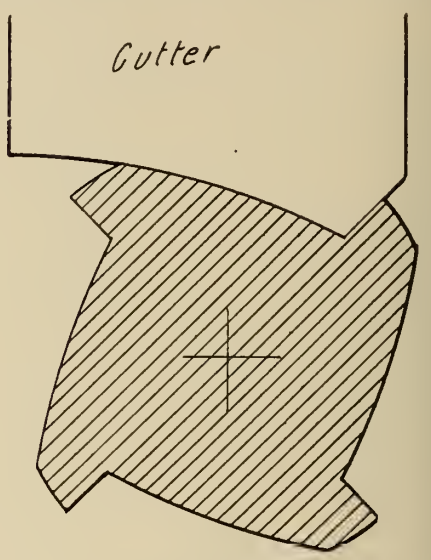


Fig 29

cutting action or the scraping action necessary in the reaming of brass and other soft compositions.

Special Cutter for Fluting Tops.

The best practice in design necessitates a specially shaped fluting cutter. This cutter is shown in Figure 27. This design makes a much stronger tap, as it does not remove so much metal from the centre of the tool. Data for setting this cutter is given in Table VII, obtained from the same source as the foregoing table.

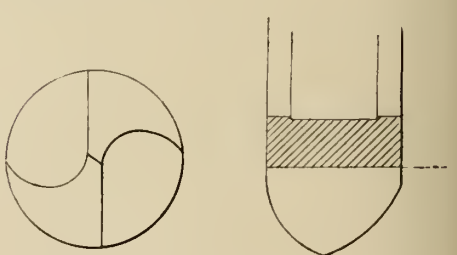


Fig 30

Table VII.

Data for setting tap fluting cutters :

Dia. of tap.	No. of cutter.	D.	C.
1-8	1	0.025	0.025
5-32	2	0.003	0.031
3-16	2	0.018	0.037
7-32	2	0.034	0.043
1-4	2	0.050	0.050
9-32	3	0.028	0.056
5-16	3	0.043	0.062
3-8	3	0.075	0.075
7-16	4	0.031	0.087

Dia. of tap.	No. of cutter.	D.	C.
1-2	4	0.062	0.100
9-16	4	0.093	0.112
5-8	4	0.125	0.125
11-16	5	0.081	0.137
3-4	5	0.112	0.150
13-16	5	0.143	0.162
7-8	5	0.175	0.175
15-16	6	0.093	0.187
1	6	0.125	0.200
1 1-16	6	0.156	0.212
1 1-8	6	0.187	0.225
1 3-16	6	0.218	0.237
1 1-4	6	0.250	0.250
1 5-16	7	0.168	0.262
1 3-8	7	0.200	0.275
1 7-16	7	0.231	0.287
1 1-2	7	0.262	0.300
1 9-16	7	0.293	0.312
1 5-8	7	0.325	0.325
1 11-16	8	0.243	0.337
1 3-4	8	0.275	0.350
1 7-8	8	0.337	0.375
2	8	0.400	0.400

Special Cutter for Fluting Reamers.

A cutter especially designed for fluting reamers is shown in Figure 28, and this cutter, when set as shown, will mill a flute giving the face of the tooth a negative rake which has the scraping action mentioned above. This rake may vary from 5 to 10 degrees, but is made on standard cutters about 8 degrees. This cutter produces a very good looking reamer, as will be seen from the cut.

Figure 29 shows a cutter for milling four lip twist drills, such as are used for drilling out cored holes. These drills are nearly always made with spiral flutes, the angle of spiral being from 15 to 30 degrees.

In Figure 30 we have shown the cutter used in grooving twist drills. This is a special shape which produces the straight lip drill, shown at the left of the figure. For small drills an ordinary circular-shaped cutter is used, and it answers the purpose very well; but for drills of larger sizes the cutter shown in Figure 29 should be used.

As mentioned above, these cutters are all "stock" cutters, and can be obtained on short notice.

Should They be Bought or Made.

It is always a question with the user of milling cutters as to whether it is better to buy or make them. There is but little doubt that milling cutters, such as are listed as standard cutters, can be bought more cheaply, and that a better grade of cutter can be obtained from makers of milling cutters than can be had in "home-made" tools. Why? For the very reason that manufacturers have special machinery at their disposal, and they are also familiar with the grades of steel used, so that the best results are obtained in both making and hardening the cutter. When we consider special cutters, it is a different matter, and whether it is cheaper to buy or make is dependent on the equipment the user has on hand, and upon whether the cutter is wanted immediately or not. It is wholly a matter that must be decided on the spot.

Last of Series of Articles.

This article is the last of the series, and it is to be hoped that the object of the series has been obtained, and that the reader has at least reaped as much benefit in reading as the writer has in the preparation of the several articles. It has not been the object to give more than a glimpse at the subject, merely familiarizing the reader with the ordinary run of practice in the art of milling.

Zinc and its Manufacture

IN a recent address before the Metallurgical Society at University of Birmingham, Eng., Professor Turner said there was no ancient metallurgy of zinc. It was the last discovered of the common metals. It possessed several peculiar properties, and one of the most remarkable at the present time was that it was not chiefly made in America. It was manufactured on a considerable scale in England, largely from British ore.

Zinc was first mentioned by Paracelsus in 1530, so that its history was comparatively recent, but as a matter of fact, it had been accidentally produced earlier on a number of occasions. It was not recognized, however, as a separate metal. In the ruins of Cameros, destroyed about 500 B.C., a girl's bracelet made of zinc was discovered. Up to the end of the sixteenth century zinc was only used on a small scale, and was brought from China and India. In 1625 Glauber knew that zinc could be produced from calamine, which was sometimes nearly white, but was generally colored. Calamine had been used for brass making in Birmingham, where the brass houses that used to stand in Brasshouse Passage were taken down less than a century ago.

Henckel in 1721 was stated to have been the first intentionally to make zinc, and of all western peoples the British first manufactured zinc on a large scale. A Scotchman named Lawson went to China and found out how zinc was made there, and on his return to England works were set up in Bristol in 1740 by Champion, and for some time England was the chief zinc-producing country in the world.

The process of extraction was very costly at first, and zinc sold for as much as ten times its present price. Zinc manufacture was introduced into Belgium by Douy a hundred years ago, and into Silesia by Ruhberg, who had learnt the process whilst on a visit to England. These processes continued side by side with but little improvement until about 1865, when gas-firing was introduced, from which time dated the really modern metallurgy of zinc. The various improvements introduced since then included the extended use of blende as a source of zinc, the more efficient preparation and concentration of ores by magnetic concentrators, oil processes (especially with the recent improvements with the use of the vacuum), and the flotation process by means of acidulation such as was used in the Broken Hill district. After referring to improvements in calcining-furnaces, especially those with multiple beds, and mechanically stirred, Professor Turner described in detail the Merton calciner, which has recently done excellent work with zinc ores. He also described other modern developments such as the introduction of gas-firing, including the use of natural gas, and of hot gas from producers attached to the reducing furnaces.

It was the introduction of natural gas in the Kansas industry that had brought the United States so much to the front in zinc manufacture in recent years. Professor Turner said that although he was very much impressed with the order, economy, and skill displayed in Belgium, he felt that the modern process of making zinc was not the best.

Positiveness is a virtue. It is well to have opinions of our own if they are well matured, and to hold to them with firm and tenacious grasp. A man with no opinions is sadly wanting in the quality of manly character. He never can be a force or an influence in the community. One must stand for something and people must know where one stands.—Busy Man's Magazine.

Tricks of the Trade

Everybody is invited to contribute to this page. Send in your ideas, odd jobs you are doing, and anything of interest to fellow-workmen. Remuneration will be made for such contributions. [Ed.]

THREE-INCH PUMP VALVE TOOLS.

FIGURE 1 shows a 3-in. valve seat for the discharge heads in a large pump; and having three hundred of these to machine, we made the following tools in order that the job might be facilitated. Figs. 2 and 3 show the construction of the box tool, which is made of cast iron, and which is supplied with a machine steel shank. The cutters are easily adjusted by the screws, as shown in the sketch, and are made from $\frac{1}{4}$ in. to 1 in. steel. Figs. 4 and 5 show the die in detail, the body being of cast iron, with an inserted machine steel shank. The slots for the dies are machined, and a keyway 1-16 in. x $\frac{1}{8}$ in. is cut down the centre to locate the dies accurately, which is shown at (A), Fig. 5. It is easily adjusted for diameter by the screws, the dies being made with a raised piece on them to correspond with the slot in the holder. Before the dies are set for cutting the thread in the valve seat, a piece of .010 sheet iron 1-16 in. wide is inserted behind the dies at (B), Fig. 4; this provides for a clearance when the die is hardened and placed hard up against the holder ready for use. Figs. 6 and 7 show the box tool for turning the shanks and facing the seat, and also for cutting the shank to length. The first cutter, Fig. 7, turns the shank to size and allows it to pass into the box of the holder, coming in contact lower down with the second cutter which turns the smaller diameter on the shank. The inserted tool for facing the end to length is seen in Fig. 7, and also in the elevation, Fig. 6. The tool faces off the end until the seat is perfectly machined by the top cutter. All the cutters are easily adjusted by the screws. The body is cast iron with an inserted machine steel shank. The lines running at an angle shows the slot cored to that point to allow the cutter to be withdrawn. The first operation in the machining at the valve was to turn and thread the large end using the tools in Figs. 2 and 4, which are there shown in elevation and in a plane view in Figs. 3 and 5, the small end being chucked with the three arms supported by an extended piece from the chuck. The edge is first chamefered and then the box tool, Figs. 2 and 3, is put over it, finishing the outside diameter of the threaded part, and at the same time facing and turning the collar; the die is then run over it, which completes the operation. The second operation is to screw the valve into a master chuck and turn the shank, and face the seat, which was done with the tool in Figs. 6 and 7.—F. E. Lauer, Plant Superintendent, Dominion Henderson Bearings, Toronto.

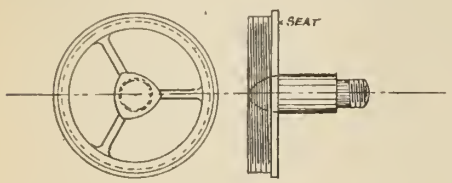
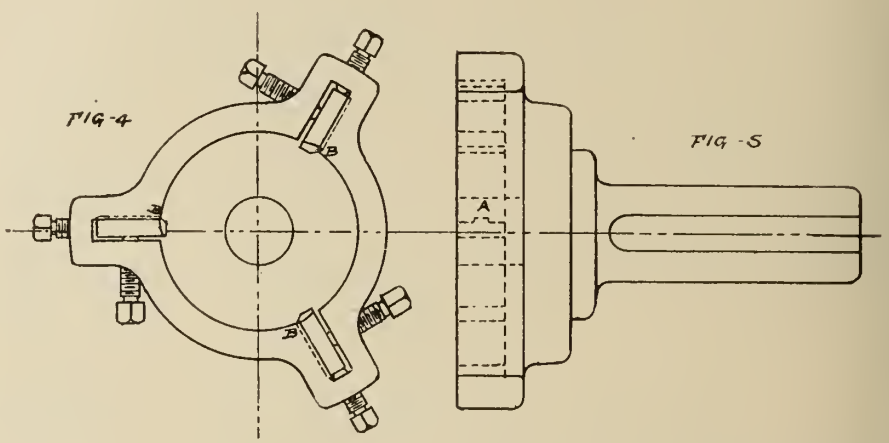
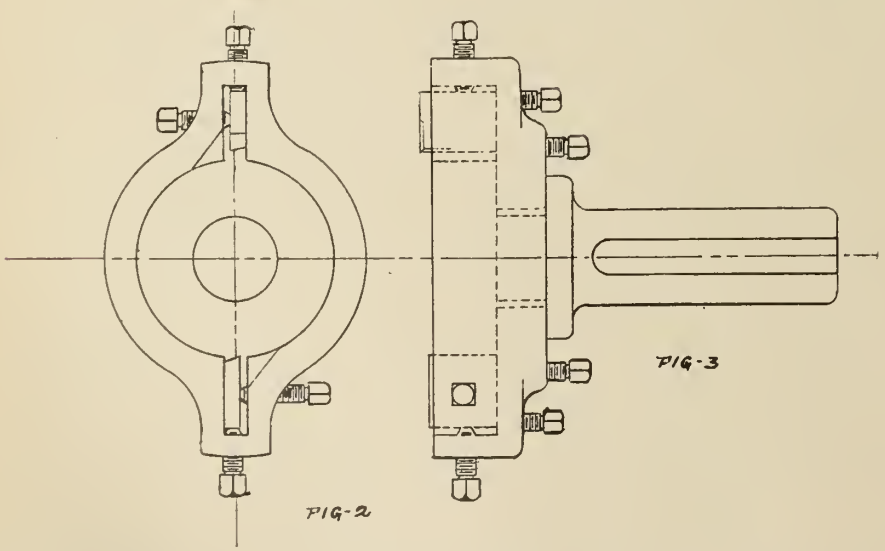


FIG-1





SYSTEM IN KEEPING TOOLS.

IN reading over the article on the above subject which appeared in "Tricks of the Trade" column in the September issue, it occurred to me that "J.C.A." has rather too much "red tape" about his tool room system, and it might prove of interest to suggest one which would be much less complicated and which is proving very successful in shops which I know.

The tools are arranged in the tool room, each tool having its place. Upon entering the employ of the company each machinist is supplied with a certain number of tool checks, which are his property as long as he remains with the firm. When he wishes a tool from the tool room he deposits one of his checks in place of the tool, and at one time he can have as many tools out as he has checks, and no more. The door of the shop is kept continually locked, with someone there to give out the tools and take in the checks, and look after the tools generally.

In some shops I have been in the door of the tool room is left open and each man gets the tools himself, and deposits the check himself, but this has not been satisfactory, because under these conditions too much is left to the honesty of the machinist, and the chief value of the system is lost. In starting a tool room system the locked door

system in the only one, but the changing from an open door system to a locked door system is sometimes hard, especially in a shop where the machinists have been in the employ of the company for a long time.—Machinist, Toronto.

WAIT BUT WORK.

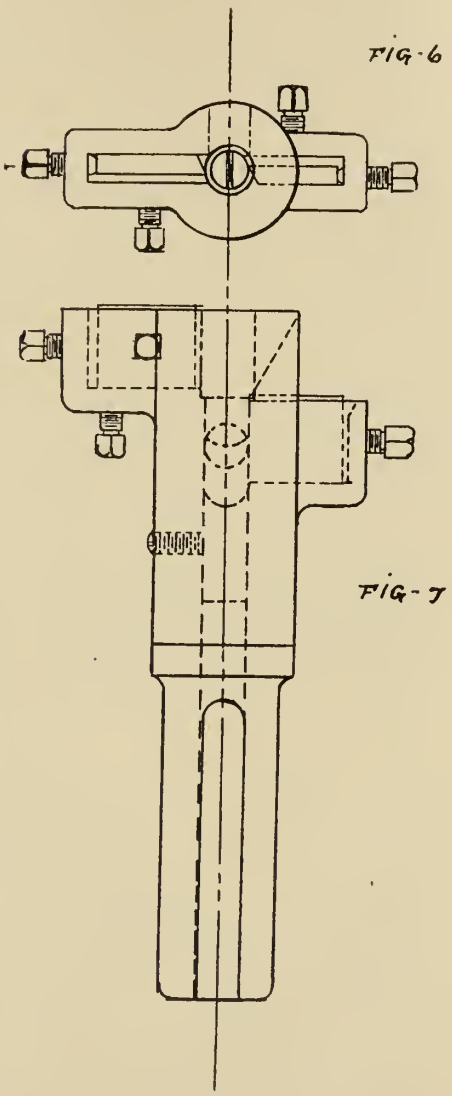
"ALL things come to him who waits," but the waiting must be done actively and not passively. This statement might, with reason, be revised to read: "All things come to him who waits and works." Some may take exception to this statement thinking that, while the waiting and the working are important considerations, cleverness is too important a factor not to be included. It is true that quickness of perception means a great deal to a person, but the cleverness of the cleverest person will not bring him position unless he has an aim, and works hard to accomplish that aim; and sometimes a supposedly dull person has as good a chance of reaching the desired position, because he has perseverance and the ability to work.

The law of compensation is noticeable on every hand; every person has characteristics which help him on and others that keep him back. In nine cases out of ten the very bright and clever person lacks the ability to apply himself unreservedly for any time, and this is as great a drawback to him as lack of quick perception is the dull person. It is natural that lack of stick-to-itiveness should be developed in a person who picks up his education quickly and easily, and that a dogged perseverance should be developed in one who has to work hard for all he gets.

The fable of the hare and the tortoise is no fable, but an axiom of life. Instances every day prove that a person with the right kind of ambition starting out handicapped leave a more lasting impression in the world than a person with the same ambitions, but in whose way there are no rocks. It is the overcoming of obstacles that develops strength of purpose.

This all goes to show that every apprentice in any machine shop has a legitimate right to aim to become foreman, or one of the foremen, of that shop, or to become draughtsman, or to secure some other position of responsibility; and that every machinist in a machine shop has a legitimate right to aim to better his position in the shop. Of course every one cannot be a superintendent, a foreman or a draughtsman, but to each individual this competition should prove an inspiration, nor will he who shrinks from competing with all ever win out. It is for each competitor to wait and work, and the way to work is to fill the present position in such a way as to prove to the superintendent one's ability to fill a more responsible one. Then, when there is a responsible position vacant, the superintendent will know whom to recommend.

The more interest a machinist puts into his work, the more pleasure he will derive from it, and the more he will feel like improving himself. In these days the machinist, if he wishes to rise, cannot be content with the knowledge he picks up during working hours. The advances in the processes of manufacturing of recent years have been the result of the increased application of scientific and technical knowledge, and the machinist of to-day must take advantage of the many opportunities given him of improving himself along these lines. The machinist who reads, with the idea of making himself a better mechanic, as much literature bearing directly on his line of work as he has time for, will have little trouble in keeping ahead of the machinist who depends entirely upon personal experience for his knowledge. Of course only he who is ambitious and who likes his work will spend much of his own time in improving himself. However, if success is to be attained one must court success with all one's might, and therefore it is that the ability to centre one's interests and work hard along that centre is the chief qualification to success. W.A.F.



THE WASTEFULNESS OF CHIMNEY DRAFT.

IN a discussion of the methods for the utilization of waste heat, the wastefulness of the usual method of producing draught by the ascent of heated air in a chimney must be considered.

Taking the boiler as the wasteful member in a steam plant, its efficiency varies from 60 per cent. in a bad boiler to 80 per cent. in a very good one, these proportions of the heat produced by the combustion of the coal being realized in steam available for the engine in each case.

The difference may be said, without greatly stretching the truth, to go up the chimney. It is not to be disputed that much of the waste heat might be caught and utilized, but there are reasons why it is not so caught. In the first place, the gases must be hot when they go into the chimney, or there will not be a draught.

As a matter of fact a draught got in this way is the most expensive possible, save one. The exception is a steam jet in the chimney. A fan can be run for about one-tenth of the power represented by the waste heat required to command a good draught. A tall chimney will cost from $5,000 to $25,000—very much more than will a fan plant. But the fan is not used and the chimney is, largely because it is essential to discharge the products of combustion high up in the air over the roofs of surrounding houses. This necessity must be taken into consideration in so far as factories are concerned, but it does not hold good of steam ships, yet we believe that in some cases a chimney stack 100 feet high would be sufficient, because with a fan combustion could be more easily controlled than is possible with a chimney, to the end of preventing the giving off of smoke.

Theory without practice is like experience without judgment, and theory without judgment is not likely to be worth much in practice. Theory in practice will work out in harmony and accomplish the desired ends, just as judgment and experience will do when combined; in fact, they are practically the same. Theory shows one side—practice shows the other, and neither is complete without the other.—The Woodworker.

Mechanical Reviews

OPINIONS AND STUDIES WORTH NOTING

AN IMPROVED PLANER DRIVE.

THE accompanying table shows how wasteful of energy is the ordinary pully rim of a planer, the size of planer taken for illustration being 84 x 66-inch x 17-foot stroke.

Fig. 1 illustrates a new type of drive, designed to largely reduce the waste of energy required to accelerate the moving parts of a planer, and bring them to rest at each end of the stroke. This is accomplished by arranging the driving pulleys so that the driven pulley may be reduced to one-half the usual width; in other words, to the width of a single belt. The pulley (A) driving the planer on the return stroke, is smaller than the pulley (B), which drives the planer on the cutting stroke, and is placed on a direct line between cutting pulley (B) and the planer pulley (C). This allows the return belt to occupy the position left by the cutting belt, and vice versa.

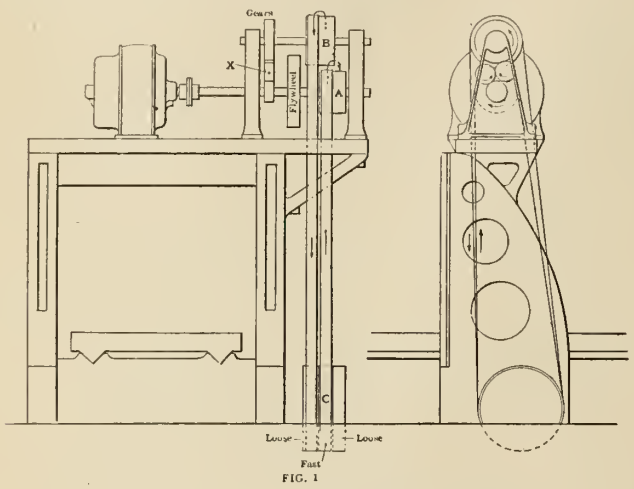


FIG. 1

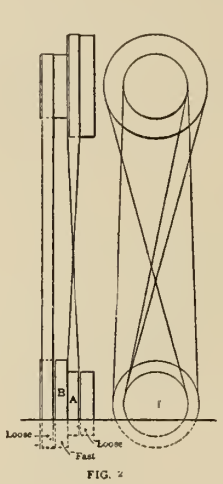


FIG. 2

A Improved Planer Drive.

Fig. 1 shows the planer equipped with a motor drive but it could easily be adapted for belt drive. The improved drive would be especially advantageous to planers equipped with an independent motor, for the size of motor is usually determined by the load due to continually reversing when the planer is working on short strokes, and not by the cut. The saving in the cost of the motor would pay for the extra cost of driving gear. The planer could have variable speeds by inserting change gears at (X).

Referring to the table, the figures in column 1 are taken from an up-to-date planer of 1904. The driven pulley is 10½ inches wide, the belt being about 4½ inches. The cutting belt works on one-half of the pulley, and when it is shifted, the return belt is moved onto its other half. The difference of speed between cutting and reversing is obtained by a difference of belt speeds obtained by overhead pulleys.

Column 2 gives the figures worked out for the same planer, but the improved drive illustrated in Fig. 1, and shows a saving of 28 per cent. in the total ing parts at the end of each stroke, and as the square of the velocity. Therefore, if the planer under consideration therefore a reduction of about 20 per cent. in the size of motor required.

Column 3 shows the figures worked out for the same planer, but using slower belt speeds, the driven pulleys being reduced from 3 to 2 feet daimeter, but increased in width from 5½ to 7½ inches to give about the same driving power, the revolutions per minute remaining as before and the drive being of the improved type as shown in column 2 and Fig. 1. This column of figures brings out very forcibly the advisability of keeping down the belt speeds to a moderate figure, and shows the great waste of energy often resulting when speeding up existing planers by simply increasing the speed of the belts, by putting larger pulleys on the line shaft.

The wastefulness of high belt speeds is aggravated somewhat in the case of a planer with pulleys arranged as illustrated in Fig. 2 and worked out in column 4. With this type of drive the highest belt speed is obtained with the belt on pulley (A), when the table is returning. If the speed of the belt on pulley (A) be 3,900 feet per minute, then the speed of the rim of pulley (B) when running idle, will be 5,200 feet, the energy in a moving body going up

	1. High Belt Speed Drive Described in the fourth Paragraph.	2. Improved Drive Shown in Fig. 1 with High Belt Speed.	3. Improved Drive Shown in Fig. 1 with Low Belt Speed.	4. Drive Shown in Fig. 2.
Speed of table when returning in feet per minute	100	100	100	100
Speed of return belt in feet per minute	4,300	4,300	2,866	3,900
R.P.M. of pulley when table is returning	456	456	456	557
Size of driven pulley	3'0" dia. 10½" wide	3'0" dia. 5½" wide	2'0" dia. 7½" wide	2'3" dia. x 5½" reverse. 3'0" x 5½" cutting.
Weight of table in pounds	18,000	18,000	18,000	18,000
Weight of pulley rim in pounds; rim ¾ inch thick	82½	43	42	both rims 75½
Accumulated work in table when returning, i.e., foot pounds required to accelerate t full return speed	780	780	780	780
Ditto in pulley rim	6,584	3,450	1,490	both rims 7,400
Ditto in pulley arms	2,100	2,100	1,200	4,000
Ditto in gears	1,700	1,700	1,700	1,700
TOTAL	11,164	8,030	5,170	13,880
Ratio of energy required to accelerate pulley rim to energy required to accelerate table	8.5 to 1	4.5 to 1	1.9 to 1	9.5 to 1
Saving in energy required to accelerate all moving parts at end of each stroke. Per cent.	0	28	53	minus 24

FIG. 3—An Improved Planer Drive.

were equipped with this type of drive, it would require 24 per cent. more energy to accelerate moving parts than would be the case of a planer equipped with ordinary drive worked out in column No. 1.—W. H. Henley, in American Machinist.

CAST IRON GAUGES.

IN making up large plug gauges it is a usual custom to make them out of tool steel, hardened and ground, but I find that fine grey iron, carefully turned and ground, gives good satisfaction and lasts a long time; besides cast iron lends itself to cored construction which lightens the gauge. It is also convenient to change the handle from one to the other, in case there are different sizes. Fig. 1 shows a straight plug 3 inches diameter, and Fig. 2 shows a taper plug and shell gauge, using the same handle. In making taper rods and taper holes the gauges

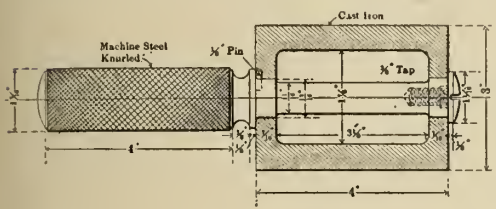


Fig. 1

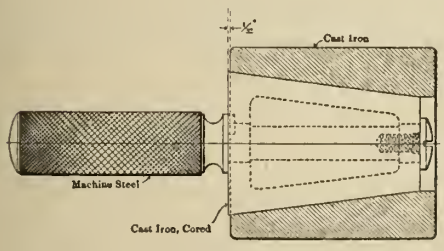


Fig. 2.

are used as follows: The plug is allowed to extend out of the hole 1-32 inch after reaming, and if the rod is fitted to within 1-32 inch of the shell, when they are tightened together, it will be about right to give them a good seat. Usually for brass I allow a little more than 1-32 inch.—I. N. Quire, in Machinery.

THE USE OF NAIL CORES.

THE use of nail cores in perforated cast iron strainers for the intake or suction end of pipes for pumps will be found a very simple and economical method of executing work of this character. While the manner of coring the holes is shown as applied to a strainer of cylindrical form as shown in Fig. 1, it can be applied to almost any form. It is particularly well adapted to flat work such as strainer plates, furnace door baffle plates, etc. The pattern is parted longitudinally and turned up as shown in Fig 2. It will be observed that the core print is turned with a shoulder (A), this being done to insure its proper setting into the mold. The mold

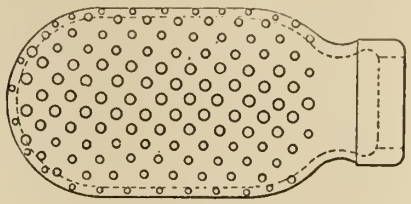


Fig. 1

having been rammed up in the ordinary manner and the pattern drawn, the nail cores, as shown in greater detail in Fig. 3, are set at proper intervals around the mold as shown in Fig. 4. The body core shown in Fig. 5 is then placed in position and supported by the nail cores. These cores are similar to those commonly used in coring babbitt anchorage in bearings.—H. J. McCaslin, in Foundry.

GAS TURBINES.

THE unsolved problem of the gas turbine, while calling forth a vast deal of theory, has hitherto been the occasion of very little practice. Some pertinent remarks made recently

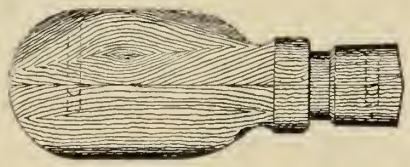


Fig. 2.

before the Societe des Ingenieurs Civils, by M. Sekutowicz are worth quoting in this relation. The author notes that M. de Laval, recognizing the suitability of his turbine for the purpose, proposed on perfecting it to construct a gas turbine on similar lines, but that hitherto no such turbine has come on the market. He also remarks, very justly, that although the difficulty of adapting a separate compressor should not be un-

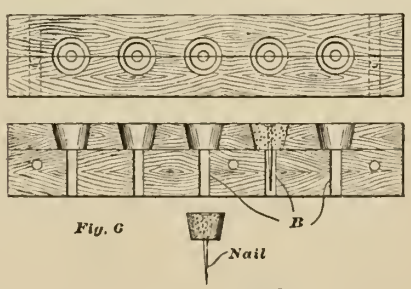


Fig. 6 Fig. 3

derestimated, it should not, on the other hand, be regarded as practically insurmountable. It is with this problem of separate compression that the matter rests at present. So far as can at present be judged, such an accessory is indispensable to a turbine of the de Laval type, and the work of reducing it to a practical form will have to be undertaken before a satisfactory or even, so to speak, a preliminary gas turbine can be produced.

M. Sekutowiez further remarks that apparently no sensational invention is to be looked for with regard to the gas turbine, i.e., no new application of the energy derived from the sudden expansion of the gas employed, which will enable a modified form of machine to be introduced without the accessories now deemed necessary.

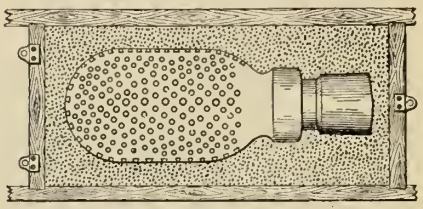


Fig. 4

The difficulty with the forms of gas turbine hitherto introduced has been the intermittent nature of the pressure, rendering the interposition of a piston in some part of the apparatus unavoidable. The theory on which the Diesel engine is based, i.e., the introduction of such a proportion of gas into a quantity of air that the combustion and consequent expansion is practically continuous, would seem to offer the most satisfactory indication of the direction for development. The accidental combination of brains (which are cheap) with money (which is dear) will ultimately result in the necessary experiments.—Le Journal de l'Electrolyse.

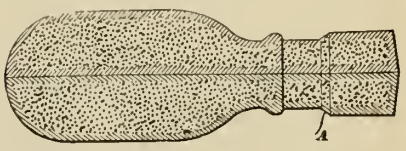


Fig. 5

MAKING THE BEST OF THINGS.

There is scarcely anyone who does not think but that he has been unjustly dealt with, in some respects, either by nature or fortune. What is to be done? If these individual imperfections can be remedied let us strive in every legitimate way to help ourselves. If not, why not make the best of them?

It is not so much our own actual condition of life that breeds happiness as the use which we make of our opportunities. Some people will be cheery and useful anywhere, and under any livable conditions. Others are correspondingly dismal. Therefore, as a matter of self-convenience at least, let us make the best of things.

Practical Questions and Answers

Automatic Engines.

Ques.—Why are certain engines called automatic engines? Wherein does the significance of the "automatic" lie?

Ans.—An automatic engine is one equipped with an automatic cut-off governing mechanism. The engine is governed by the automatic variation of the point of steam cut off. That is, should the load on the engine decrease, the governing mechanism cuts off the steam supply earlier in the stroke, thus decreasing the area of the indicator diagram, should a steam indicator be attached, which is an indication of a decreased amount of power transferred from the steam to the piston for that stroke; should the load increase, the cut-off is made to take place later in the stroke, giving an increased amount of power for that stroke.

Gasoline Vapor and Air Mixture.

Ques.—Suppose we have a mixture of gasoline vapor and air, the proportions of air to vapor varying from eleven parts air to one of vapor. Will any one of these mixtures completely burn if heated to the temperature attained by an exploded perfect mixture of gasoline vapor and air?

Ans.—To make the operations of a gas engine practical, ignition of every charge that is taken into the cylinder is necessary, consequently only mixtures most easily ignited can be considered. One to eleven is all right and comes within the range of easy ignition. But anything like one to 75 or 100 is entirely out of the question. And if such a mixture were completely consumed at the high temperatures referred to, what heat or power value could be expected from it? The gaseous vapor with about eleven parts of air might be consumed if the temperature were raised away above the ignition point of a perfect mixture, and the other 69 or 89 parts of air would simply be exhausted as heated air or gases, without having contributed anything whatever to the power value of the portion consumed.

Value of Reheating Steam in Compound Engines.

Ques.—Can you furnish data as to the exact value of reheating steam in its progress from the high pressure to the low pressure cylinder in a compound engine?

Ans.—The results of a test made by E. G. Miller, which were discussed in a paper by him before the Institution of Mechanical Engineers, in 1904, will probably answer this question. The engine tested was running at 65 r.p.m., and was operating on superheated steam at 155 pounds pressure per square inch, at a temperature of from 141 degrees to 450 degrees Fahr. During the tests the average indicated horsepower was 980, and the mean steam consumption obtained by measuring the water fed into the boiler was 11.3 lb. per i.h.p. hour. With the reheater in use the steam consumption was 0.51lb. less than when the heater was not used. The use and nonuse of the reheater considerably affected the relative outputs of the two cylinders. When the engine was working with steam in the reheater, the power in the high-pressure cylinder exceeded that in the low-pressure cylinder by about 17 h.p. On the subsequent test with the reheater out of use, the high-pressure cylinder developed about 103 h.p. more than the low-pressure cylinder, being about 44 h.p. increase on its previous load. Assuming that the point of high-pressure cut-off remained the same with the reheater in use as without the reheater, then under the latter condition, owing to condensation, a less quantity of steam would enter the low-pressure cylinder, and less power would be developed in the cylinder than with the reheater—that is to say, the reheater substantially increases the available power of the engine.

Why Dynamos Fail to Generate.

Ques.—What are the various causes why a dynamo will fail to generate current when operated; and what are the symptoms of each cause and the remedy?

Ans.—There are various reasons why a dynamo when operated will not generate a current or will not, within a reasonable time, build up the voltage for which the machine is designed. The chief reasons among these are as follows:

First, the risidual magnetism may be destroyed or may be too weak for the armature to generate a current. The symptom of this is the lack of attraction of the poles for a piece of iron placed in their vicinity. The remedy for this is to pass a magnetizing current from some outside source through the field coils.

The cause of the destruction of the risidual magnetism in the field of the machine are chiefly these: Vibration or jar, the proximity of another machine; and several other of minor importance.

Second, reversed connections or reversed direction of rotation. The symptom of this is that when the machine is running, the pole pieces do not attract a piece of iron. The remedy for this is to reverse either the armature connections or the field connections, but not both; or to move the brushes through 180 degrees for two-pole machine, 90 degrees for a four-pole machine; or reverse the direction of rotation.

Third, a short circuit in the machine or external circuit. The symptom of this is weakened magnetism in the poles which is usually to be detected by the lessened attraction of the poles for a piece of iron. If the short circuit is in the machine windings the only remedy is a careful inspection or test to locate the short circuit and then a proper fixing of it. If the short circuit is in the external circuit it will prevent the shunt-dynamo from building up its field magnetism until the external circuit is open, but with a series-wound motor the building up of the field magnetism will of course be hastened.

Fourth, field coils opposed to each other. In a case of this kind, if the pole pieces of a bi-polar machine are approached by a compass needle they both attract the same end of the needle; this shows them to be of the same polarity, whereas they should be of opposite polarity. In a multi-polar machine the same thing holds with each two consecutive poles. The remedy for this is to arrange the connections of the field coils so that when tested with a compass needle they will be alternately north and south.

Fifth, open circuit. If it is the external circuit which is open there is nothing to prevent the machine itself from working perfectly; but if the open circuit is in the machine itself the field magnetism will probably be very weak. The only remedy for this is to make a careful search for the open circuit, if it is external, and if in the machine, to test separately the field coil and armature with a cell of some kind for continuity of current.

Sixth, brushes not in their proper position. In a case of this kind the machine may not run at all, or if it does run, may generate only a fraction of its voltage and there will be sparking at the brushes. The proper position for the brushes depends upon the style of armature winding, and may be directly between poles or directly opposite the centres of the poles. Unless the style of winding is known this cannot be remedied in any other way than by trial. The brushes should be adjusted so that the machine will generate its normal voltage without abnormal sparking.

Foundry Practice

MODERN IDEAS FOR THE TRADE.

MULTIPLE MOLDS.*

By Jas. F. Webb, Elkhart, Ind.

THE first cost of rigging up for the multiple mold is not a great deal. You can use the same patterns that are used in a snap flask, the only change to be made is to put on two pins on the pattern board to the fit pin holes in the flask; and to put on an upright gate to connect the molds. It is good policy to have the upright gate ¼ inch shorter than the depth of the flask, and to cut through with the sprue cutter after drawing the pattern; if it is full length it interferes with the presser head. The next thing is to make a set of iron flasks. This is for molding machine practice. It is best to use iron flasks here as there is less chance for discount.

In railroad shops there is a wide range of work that can be made in the multiple mold. Fig. No. 5 shows some of our patterns rigged for multiple molds, all plain on top. In molding a 12x16 inch snap flask, 4 inch cope, 3 inch drag, there are 1344 cu. in. sand used to ram it up. In a 12x16 inch multiple mold 3 inches deep there are 576 cu. in. of sand, showing a saving of over 57 per cent. of sand to handle which is no small item in the course of a day, both in preparing it in the morning and handling it in the molds. Besides this there is the saving of floor spaee.

Twenty-four snap flasks 12x16 inches require a space of 32 sq. ft. to place them on the floor. Two multiple molds twelve high require a space of 4 sq. ft., allowing 4 in. between handles on the flask to operate them, which gives plenty of room for this purpose. This represents a saving of floor space of 87½ per cent. When business is good and room limited this is quite important.

Fig. No. 2 shows the comparative saving in floor spaee. Furthermore it illustrates how a great deal of hard work in pouring off is done away with. Snap flasks are commonly poured with a hand ladle of about 45 lbs. eapacity. Multiple

Fig. 1.—Multiple Moulds.

Fig. 3.—Multiple Moulds.

Fig. 2.—Multiple Moulds.

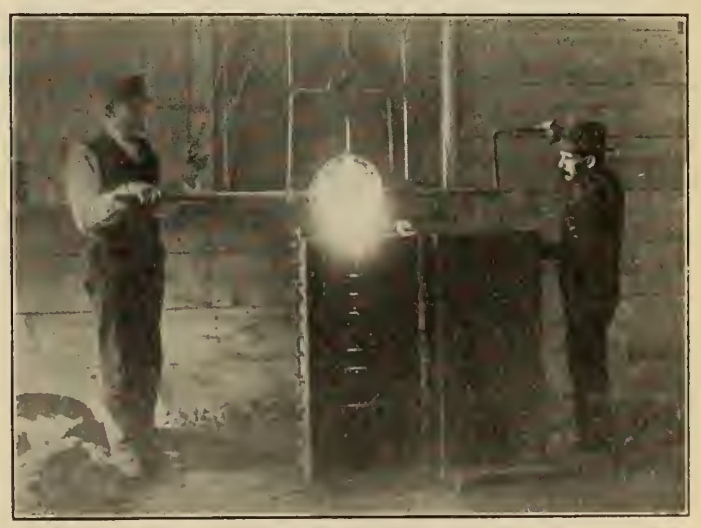


Fig. 4.—Multiple Moulds.

*Read at American Foundrymen's Convention Cleveland, Ohio.

molds may be poured with a larger ladle, say 200 lbs. capacity. An overhead trolley is a handy thing to have in pouring off.

Twenty-four snap molds that weigh 15 lbs. each mean 8 hand ladles for the molder to carry, and the same number in multiple molds means 2 ladles of 180 lbs. capacity to pour which makes it a great deal easier. (See Figs. No. 2 and 4) and the discount is not so great as in a snap flask, the loss being about 1 per cent.

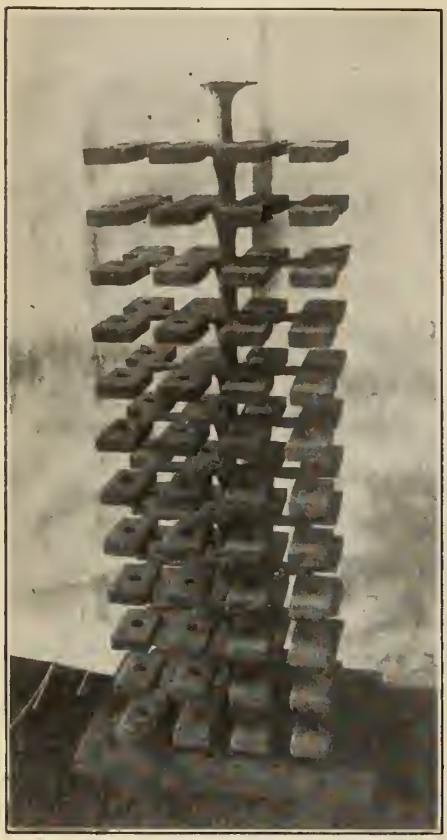


Fig. 5.—Multiple Moulds.

More patterns can be used in a flask, for they can come closer to the edge of the mold without danger of running out. See cut Fig. 5 as to quality of castings. We have patterns, where in a snap flask, twelve were as many as could be put in one mold, while in a multiple mold we now have eighteen, an increase of 50 per cent. output to each flask.

When making a multiple mold, the iron flasks must be arranged with a rib extending in about $\frac{1}{4}$ in. on the inside to hold the sand in the flask. When closing it down place the flask on the pattern board with the rib up, so that after it is rolled over it will be on the bottom. Have an iron frame to fit the top of the flask $\frac{3}{4}$ in. deep; riddle sand on your pattern and fill the flask flush with top of the iron frame. Put the presser head on and press your mold. Then take the frame off, strike off the sand even with the top of the flask, throw a little loose sand on top and rub down with a finish board, roll over, draw the pattern board and cut the gate, and place the mold on top as Fig. 2 shows. In making the bottom part of the mold use a regular bottom board and stop off the upright gate even with the other gate.

We are using the Farwell Molding machine to advantage in making multiple molds, and as it is not a high priced machine it will not cost much to try it out. One of them is shown in Fig. 1 with some of the patterns we are using in the multiple mold in connection with patterns we have on boards. We are using a brass frame on the outside of the board fastened at the corners.

The vibrator, which does away with all rapping by hand, we secured from E. H. Mumford & Co., who had just what we wanted and only cost $10.00. I don't know how we could get along without them, frame and vibrator attached being shown in cut Fig. 1 on the machine with knee valve fastened to lift the table at the right hand side.

In making these molds the gates leading to the casting want to be small enough to allow the iron to congeal and get set so as not to cause any undue strain or pressure. The metal in bottom mold gates want to set before the part above is filled. In making these molds it must be remembered that there are no bars in the flask, as they would interfere with shaking out. There should be enough sand under the pattern to keep it (the sand) from falling out. With a flask 3 in. deep we are making six castings in a flask 1 in. thick without any trouble. This allows 2 in. of sand under the pattern.

FOUNDRY COSTS

A DETAILED analysis of the costs of an iron foundry has been made at the Worcester Polytechnic Institute, Worcester, Mass., in connection with the course in mechanical engineering, and the important conclusion has been reached that the common practice of apportioning the burden cost per pound of castings produced leads the foundryman into two often unrealized errors, one that the cost of heavy castings is made too high, the other that the cost of light castings is made too low. The cost curves shown in the illustration, Fig. 1, one procured when apportioning burden per pound of product, the other procured when apportioning burden per molder's day, that is, on the basis of wages paid, show clearly the difference between the two methods of finding costs and the practical results of each.

Most iron foundries have a wide variety of work. Some of it is heavy, and the molder produces a large weight of castings a day. Some of it is light and intricate and the weight produced per day is correspondingly small. The usual practice in finding foundry costs is to lump all castings, large and small, into a grand total, and, dividing the total burden by the number of pounds produced in a year, or other given period, find the burden cost per pound. The Polytechnic investigation would indicate that much more exact costs can be procured by figuring in the burden on the basis of wages paid to molders. The total number of full days worked by all molders is secured by totaling the entire

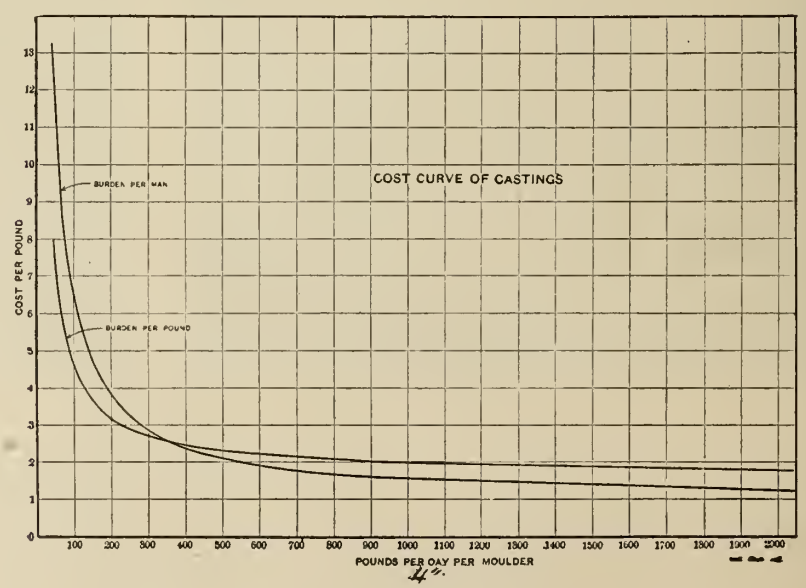


FIG. 1—Foundry Costs.

number of hours included in the molders' pay roll and dividing the total by the foundry day of so many hours. The result is the total number of days worked by all the men employed in molding. Dividing the total burden by the number of molders' days and the burden per day's pay is obtained; that is, the burden per molder's day.

The business of a foundry of moderate size was analyzed in its costs, the books of the company being available for the purpose. In the first place, as preliminary to plotting the cost curves, the costs were analyzed in great detail, with results as shown in the accompanying table, Fig. 2. In explanation of these figures it should be stated that the item of cost of iron includes every expense up to delivery on the foundry premises; the cost of melting everything to the delivery of the metal to the molders; and cleaning everything from the rough casting to the finished product, ready for shipment.

For the sake of convenience the wage per molder's day was arbitrarily fixed at $3, and the cost of iron at 1 cent a pound, melted, which thus includes both the items of cost of the iron itself and its melting. Consequently costs are reduced to three elements: Burden, molders' wages and melted iron. It makes no difference in using the burden item of the table that the cost of iron and wages are arbitrarily fixed. Percentages do not enter into the calculation, and correction must be made in any case from these two items if the curve were to be adapted for use with the cost of labor and iron in varying figures. The formula employed provides for variations in cost of labor and melted iron.

Having ascertained the burden per pound of castings produced and the burden per molder's day, as already explained, equations were formulated from which the curves were plotted. Let W represent weight of castings produced by a molder per day; C the cost per pound of iron melted; M the wage per day of the molder, and B the burden per day of a molder, and the following equation will permit the curve to be plotted from the books of any foundry, basing burden on molders' wages and not on volume of product in pounds:

$$p = \frac{(W \times C) + M + B}{W}$$

In securing the curve here shown, C is made to equal 1 cent and M $3. Substituting different weights as representing a day's work of a molder and the curve is obtained.

To secure the curve based on burden per pound of product, W represents weight of castings; C the cost per pound of the iron; M the cost per day of molder, and B the burden per pound of iron. The equation follows:

$$p' = \frac{(W \times C) + (W \times B') + M}{W}$$

The very marked difference between results obtained by figuring costs by the two methods is obvious from an inspection of the curve. As no objection is offered in the various systems of reckoning costs of manufacturing to apportioning burden on the basis of wages (in fact, it is the commonly accepted method) it is fair to presume that the curve of "burden per man" is a correct one. On the other hand, it is an universally accepted truth that where two products of the same manufacturing establishment vary in character it is not an accurate method to lump the two and strike an average based on any one factor. In such instances the best method, and consequently the most accurate, is to separate the departments in determining the apportionment of burden. This is true of the problem worked out in the two curves. It will be noticed that the two methods agree at only one weight of castings produced by a molder in a day, at 360 pounds. When the weight is greater than that figure the "burden per pound" curve runs high; at smaller weights, which means more costly castings per pound, the "burden per pound" curve runs low. For example, in figuring on some heavy work, which the molder can do at the rate of 1,500 pounds per day, it means a good deal whether the foundry figures on a cost of 1.4 cents or 1.9 cents. Half a cent a pound means a good deal in landing a contract. On the other hand, in figuring small work, or work so intricate that the molder can produce but a small weight of castings per day, the foundryman may lose money if he figures on the "per pound" basis. At 200 pounds the difference in cost between this method and the "burden per man" method is as 3.2 cents and 3.8 cents; at 100 lbs. as 4.5 and 6.6 cents; and at 50 lbs. as 7.5 and 11.4 cents. Such, at any rate, is a natural conclusion if the accuracy of the "burden per man" method is accepted, and, as already stated, cost systems usually take wages as the basis and not volume of product.

Doubtless many foundries which reckon costs on the burden per pound basis are making money, but it is argued that their profits are obtained from their heavy work, while light castings are bearing little part of the shop burden. The low prices at which many machine shops are getting their light castings is due to the fact that foundries are not working on the per molder day basis.

	Total Cost.		Cost Per Lb.		Cost Per Cent.		Cost Per Molder.	
	1904	1905	1904	1905	1904	190	1904	1905
Iron	19655.86	25626.17	0.00756	0.00840	30.46	34.35	2.58	3.09
Melting	3785.99	4113.36	0.00145	0.00135	5.87	5.50	0.497	0.496
Molding (L)	18210.39	20155.16	0.00700	0.00660	28.21	27.00	2.392	2.430
" (Sup.)	1962.43	2338.57	0.00075	0.00077	3.04	3.13	0.258	0.282
Flasks	1272.47	1479.21	0.00049	0.00049	1.98	1.98	0.167	0.178
Cores	2376.53	2535.61	0.00091	0.00083	3.68	3.40	0.312	0.306
Cleaning	2513.44	2822.00	0.00097	0.00093	3.90	3.78	0.330	0.340
Office	3879.90	4520.39	0.00149	0.00148	6.01	6.05	0.590	0.545
Miscel	3300.51	2697.98	0.00127	0.00083	5.12	3.62	0.433	0.325
Teaming	911.15	1127.57	0.00035	0.00037	1.41	1.51	0.120	0.136
Power	704.48	751.16	0.00027	0.00025	1.09	1.01	0.092	0.091
Rent & Ins	2231.19	2309.40	0.00085	0.00076	3.46	3.10	0.293	0.279
Dep. & Loss	780.96	853.74	0.00030	0.00028	1.21	1.14	0.102	0.103
Balance	2936.91	3308.76	0.00113	0.00108	4.56	4.43	0.385	0.399
Totals	64532.21	74638.38	0.02479	0.02447	100.00	100.00	8.470	9.000

1904 Sales = 2,600,092 lbs. 1905 Sales = 3,052,291 lbs.

Suction Gas: Its Production and Application

A Series of Articles on Producer Gas, Its Production and Application as Shown by German, French, English, and American Practice.

By Emil Stern *

ARTICLE I.

IN view of the great interest which has been evoked in Canada in producer gas, it is in keeping that a series of articles of this kind should be written for Canadian Machinery at this time. This article deals in an historical way with producer gas. Later will follow articles dealing with the general gas-making process and the heat efficiency of producer gas, the principal constructions adopted by different manufacturers, showing their advantages and disadvantages, hints regarding the practical working of the producers, and comparison of gas with other forms of power as to installation, fuel consumption, attendance, depreciation and interest. Then, should the interest in the series warrant it, producer gas engines will be considered.

Shortly after the invention of the four cycle gas engine by Mr. Otto, Deutz, Germany, in 1876, it was seen that the gas engine could not compete against steam engines in large units. So very soon the idea arose to get a cheaper gas and to make oneself independent of the city gas mains, so as to be able to use to advantage the gas engine outside of large cities.

The first idea was to make oneself independent of the city mains by building a small gas works near the engine to make a low grade lighting gas, but this is really not practicable for the same reason that it is not advisable to have such a gas works in a residence. Gas of this kind would have to be made in retorts and with a plant of moderate size, and the rate of producing the gas would be far slower than the rate of consumption. It would, in fact, be necessary to make gas continuously night and day, and to store it in a gasholder of considerable capacity, to provide gas enough for the comparatively short period during which it would be consumed. Apart from this it would be necessary to keep the retorts and their brick setting at a high temperature, for if they were allowed to cool it would take a long time to get up the required heat again. The first invention providing a cheaper gas for running gas engines was the Dowson pressure gas producer only two years after the gas engine was invented.

In 1878 Mr. Emerson Dowson designed and constructed a gas-making plant of which Fig. 1 is a diagram. (B) is the gas producer containing small anthracite ($\frac{3}{8}$ in. to $\frac{3}{4}$ in. cube) or small gas coke. The gas is made by forcing through the fire in (B) a mixture of superheated steam and air, the steam being supplied from a little vertical boiler (A). The steam which passes through the fire is decomposed, owing to its oxygen having a greater affinity for incandescent carbon than for hydrogen. The oxygen of the air also combines with some of the carbon. The resulting gas consists of about 18 to 20 per cent. hydrogen, 1 to 2 per cent. marsh gas, 4 to 5 per cent. carbon dioxide, 22 to 25 per cent. carbon monoxide, and about 50 per cent. nitrogen. The process is continuous, so long as it is required, and on the gas leaving the generator (B) it passes through a water seal in the hydraulic box (C). This not only helps to cool and clean the gas, but the seal prevents gas from other parts of the apparatus being fired accidentally by the incandescent fuel in (B). From (C) the gas passes through a column of coke in (D), which is kept cool and moist by a spray of water. From (D) the gas passes through sawdust in (E), and then into a small gas holder (F). From the latter it is conveyed in a pipe to the engine, while some of the gas can also be used for heating purposes if required. The benefit of the gasholder is that it maintains a constant pressure of gas in all parts of the plant, it also prevents air getting into the plant, and it gives sufficient storage capacity to cover little fluctuations in the rate of production. A useful addition is the arrangement (G) for governing automatically the rate of producing gas to suit a varying rate of consumption at the engine. A jet of steam at the pressure from the boiler (A) is used to inject into (B) the air required for carrying on the combustion

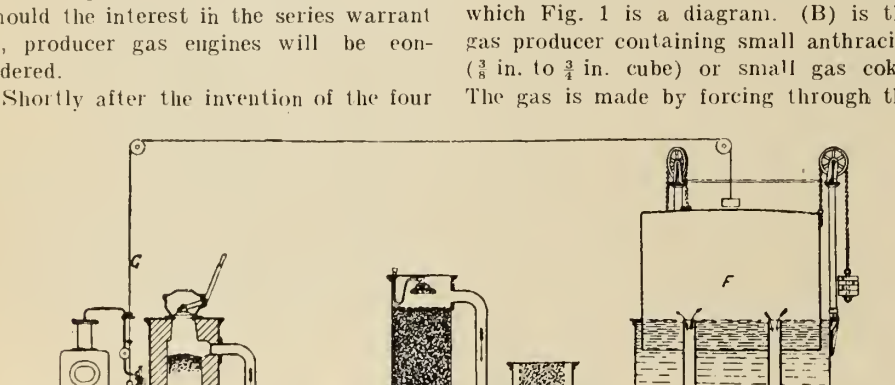


FIG. 1—The Dowson Gas Plant.

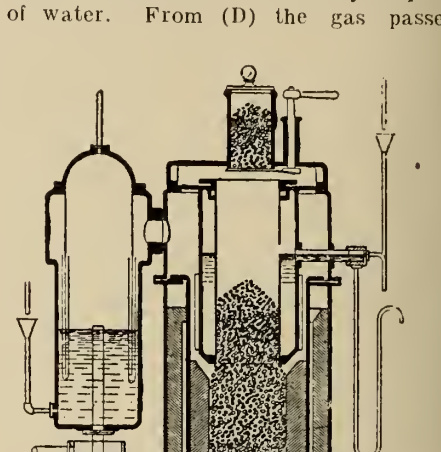


FIG. 2—The Bernier Plant.

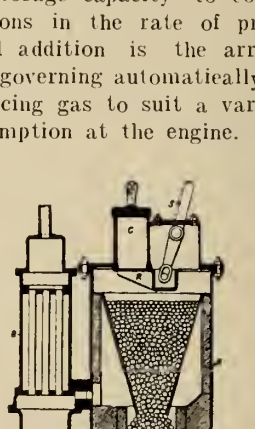


FIG. 3 The Taylor Producer.

* Consulting Engineer of the Economic Power, Light and Heat Supply Co.

of the fuel, and the rate at which gas is made depends chiefly on the quantity of steam and air sent into (B). By the arrangement (G) the rise and fall of the gasholder (F) raises or lowers a weighted lever which acts on the valve which admits steam to the injector on (B). It will be easy to realize from this that when the gasholder is low, and when the maximum production is required, the steam valve can be made to open fully, to admit the full supply of steam required. When, however, the gasholder is nearly full, and when less gas should be made, the steam valve is wholly or partly closed. In this way the rate of producing gas is regulated automatically to suit the varying load, and consequently the varying consumption of the engine.

The Dowson pressure plant, although being a success, was too complicated and took too much space and attendance to become popular. The separate steam boiler involves the consumption of about 25 per cent. more fuel than is actuall used in gas making within the generator. Nevertheless the importance of Mr. Dowson's discovery cannot be over-estimated when one considers first how rapidly the gas engine has developed in size and popularity in consequence of the resulting cheap supply of power gas; and second, how it has been possible by the experience gained from the larger engines thus called into existence to go on increasing the unit power per cylinder year by year until we may now see single and multi-cylinder gas engines in successful operation in sizes that seemed quite impossible then. These largest engines are operated with blast furnace gas but the gradual evolution from 20 h.p. to 2,000 h.p. unit has been made possible by the experience gained with those of intermediate power.

After Dowson's invention in 1878 the development of gas producers stopped for 17 years and no valuable improvements were made. Now his fellow engineers have used the position gained by his invention and have shown how a simpler apparatus can give practically similar service. The field has again been extended thereby, and now almost every power user, if he will, may take advantage of the most economical form of power yet devised and in doing so can save in working expenses a sum that, a few years ago, seemed quite impossible and incredible. And this with less risk of fatalities, fires or breakdowns.

In 1895 M. Bernier, of Paris, invented a gas-making plant working upon the Dowson principle of a simultaneous blast of steam and air through incandescent fuel, but designed to utilize the waste heat of the generated gas in making steam. This plant is shown in Fig. 2. It was M. Bernier's ambition to make all the steam from the sensible heat of the gas, as in the proper operation of engines gas has to be cooled in any case and until his experiments, all the sensible heat had been wasted. M. Bernier was successful in raising some steam at atmospheric pressure, but it was then evident that some apparatus had to be devised to force or draw the steam and air through the fire. He decided to provide an auxiliary piston by the side of the working cylinder of a gas engine, and arrange this to suck the gas from the plant and deliver it to the engine. He evidently did not consider whether or not the engine could draw its own ga or probably he thought to obtain all the power he could from a well filled cylinder even at the expense of loss in mechanical efficiency. M. Bernier's plant, while encouraging, was not very successful, although considerable improvements were made later on. M. Taylor & Co., of Paris, still further developed the producer, a view of which is shown in Fig. 3, and in their hands it became a commercial success both in France and in England. A few examples are still to be seen at work in the latter country.

In 1895 Messrs. Koerting Bros., of Koertingdorf, Germany, were also experimenting in the regenerative principles and as a result instructed their agent, C. Wiegand, of Hanover, in July, 1895, to take out patent rights for a producer which made gas only when air and steam were drawn through the fuel under the influence of a negative pressure caused by the piston of a gas engine during charging strokes. The results obtained from these experiments were discouraging and the patent abandoned. According to Mr. John Koerting, irregular working of the engine under light loads due to fluctuating low pressures through the plant, was experienced and it was felt that the pressure type was the more effective. In the light of the experience since gained it is not difficult to imagine the poor results achieved. The separate steam boiler was still an essential feature as was also a gasholder which, however, provided with balance weights and rollers, would give very unsatisfactory variations of pressures due to friction of moving parts and the inertia effects of the bulky "bell."

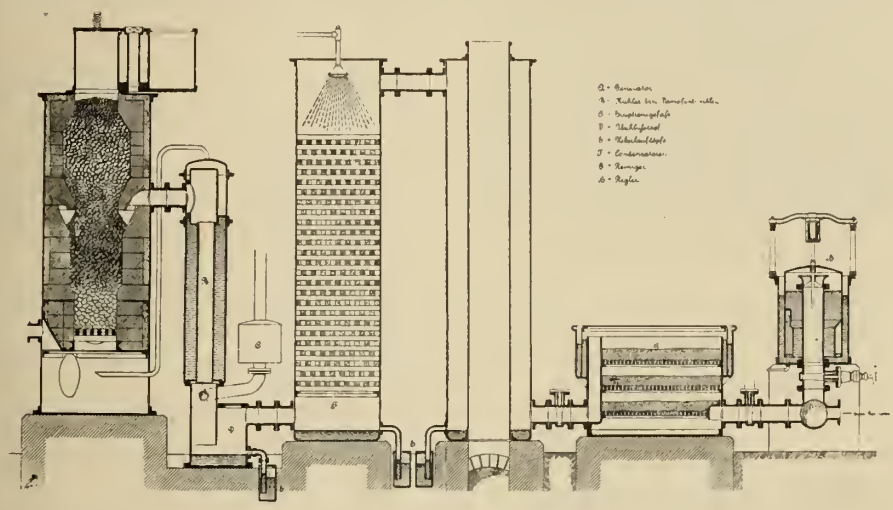


FIG 4—The Earliest Pintsch Producer.

In 1901 the firm of Julius Pintsch, of Berlin, made and erected a suction plant of their own design for T. Geotz & Conrad, to serve a gas engine driving an electric light and power plant at Heusy, a suburb of Verviers in Belgium. The T. Geotz Co., when accepting the order for the engine, were very doubtful about the proper working of the engine with the producer and made it quite clear from the first that, in their opinion, successful operation would only be obtained by the addition of a separate boiler and gas holder. After erection ten days were spent in trying to start the engine, and it looked as if the gas engine firm's distrust was justified. Mr. H. Gerdes, chief engineer to Messrs. Pintsch, was then sent for and after properly adjusting all details and superintending the proper blowing up of the fuel, he had the satisfaction of seeing the engine started off splendidly and the installation has ever since been in successful operation.

Fig. 4 shows a complete diagram of the Pintsch producer. (A) is the producer; (B) is the steam boiler, the steam being generated by the hot gases passing through it; (C) is a safety box which is left out on modern plants as unnecessary; (D) is a syphon; (E) are overflows; (F) is a wet scrubber filled with wooden grids; (F) is a special water separator; (G) is a sawdust purifier; and (H) is the governor. This plant is not much different from the type now manufactured by the same firm.

The advantages of the new system of generating power were so striking as to excite the whole world to competition, and really since that day, hundreds of manufacturers have been offering suction gas plants of any size and for any price.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

A NEW INSIDE MOLDER.

THE accompanying illustration is of a new molding machine which is now being placed on the market by the S. A. Woods Machine Co., Boston, Mass. The machine embraces a number of new features, which features the builders say have been thoroughly tested and proven good. These improvements qualify the machine to perform all the duties that modern practice would require of a molding machine, and it also may be used as a planer and matcher. One of the chief improvements in the new molder is the providing of special hold-down features and bar adjustment in order that the machine may be adapted to working flooring in an efficient manner. The features which make the machine adaptable as a planer and matcher are . vertical adjustment of the side spindles from above the frame while the machine is running ; edge guides and hold-downs, after cut, attached to matcher plates similar to planers and matchers; parallel adjustment of top pressure arms, also independent adjustment of either end and pressure-shoes; bar, after top cut, travels vertically with the top cutterhead; bar before bottom head adjustable on a horizontal plane from the outside by means of a crank; quick adjustment of all bars for more or less opening, as desired.

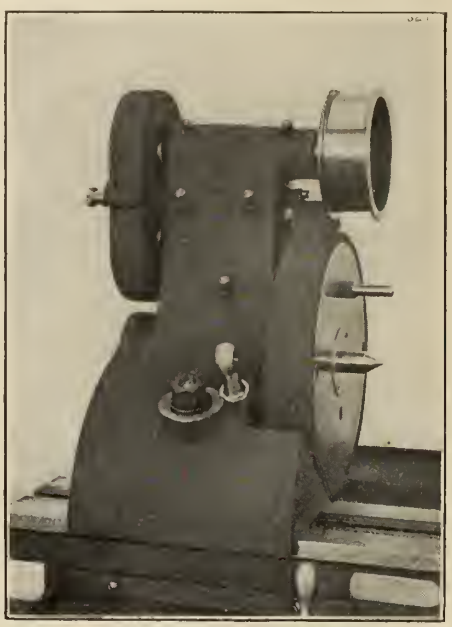


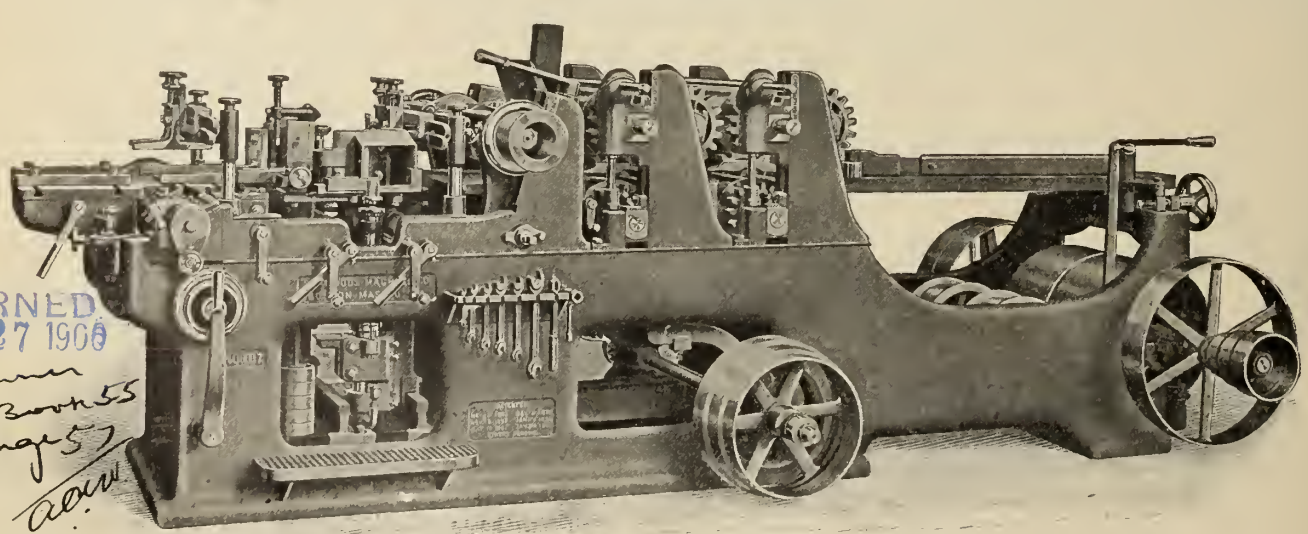
FIG. 1—New Style of Head Stock.

guides—provision also made for vertical adjustment; end table has independent horizontal movement and can be drawn out for access to cutters; patent adjustable knife-setting gauges; parallel plate under top head for projecting cutters; top chipbreaker fitted with sectional shoes, each independently adjustable, vertically, horizontally or on an angle; extra swivel to matcher works; swinging pressure-arm with screw adjustment for side heads. This new molder is built to work 12 or 15 inches wide by 6 inches thick, and with four or five heads.

NEW STYLE OF HEADSTOCK.

THE accompanying illustrations are of a new style of headstock now being used by the Landis Tool Co., Waynesboro, Pa., on their grinders. In the headstock formerly used the spindle was driven direct from the countershafting by belt, and it was found that sufficient power could not be obtained in this way to allow for the style of cuts that were warranted by the grinders. Then, too, an adequate range of speeds could not be obtained. To overcome these difficulties a geared headstock has been designed, the spindle being driven indirectly through gearing from the countershaft. In the arrangement the driving pulley can be run at a high rate of speed, and in the reduction of speed to the spindle a greatly increased torque on the spindle can be obtained.

This head contains five mechanical



A New Inside Moulder

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Other special features of the molder are : patent side wing, self-oiling, self-adjusting clamp boxes; belt-releasing device for matchers (patent pending); hoist for bottom head from working side, also independent adjustment of either end from same point; patent pin-setting guide; renewable and adjustable changes of speed, which are obtained by shifting a notch bar. The notches which engage the clutch pins are so spaced relative to the distance between

centres of the clutch pins that only one clutch pin can be engaged with its respective gear wheel at any one time.

Fig. 1 gives a view of the headstock, while Fig. 2 shows the class of work

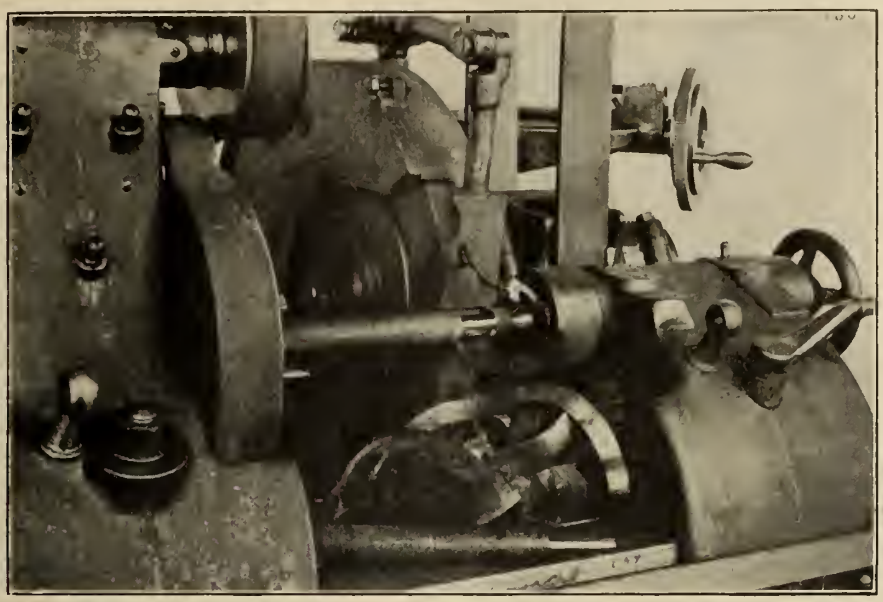


FIG. 2—New Style of Head Stock.

which can be accomplished with the Landis grinder when equipped with this headstock.

Corundum is used in the manufacture of their wheels, and some special wheels have been designed for heavy cutting, such as shown in Fig. 2.

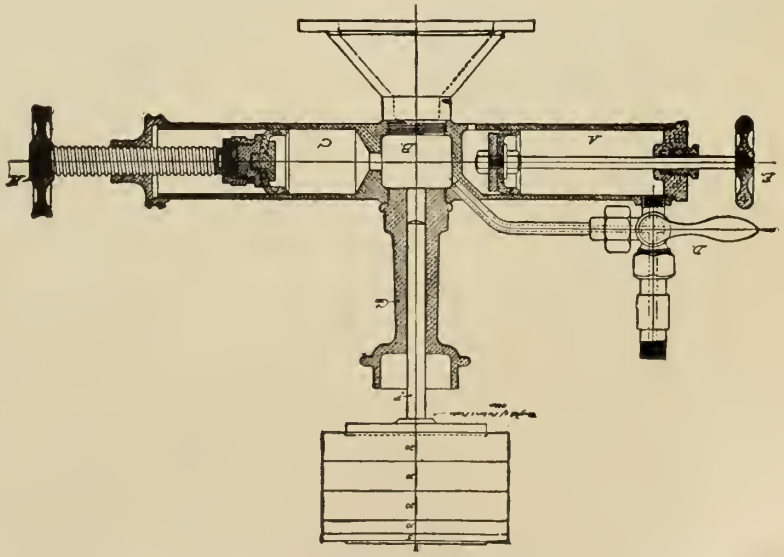
A NEW STYLE OF GAUGE TESTER.

AN improved dead weight gauge tester has recently been placed on the market by the American Steam Gauge & Valve Mfg. Co., Boston, Mass., which is shown in the two accompanying illustrations. The makers claim that it possesses all the advantages of the mercury column, enclosed in a much smaller space, and that it is perfectly accurate. The accompanying illustration is a sectional view of the gauge, and the following description of its construction and operation will be of interest :

The principal parts of the pump are a chamber, (B), connected directly with the gauge to be tested, and the cylinder (G), containing the piston (F), upon which the weights act, the cylinder (C) having a screw plunger for raising the piston (F) under weight and the auxiliary oil chamber (A) having a plunger for filling the connection between the gauge and the main chamber (G) through the three-way cock (D). The weights and the area of the piston (F) are proportioned to produce directly on the gauge to be tested the pressures indicated on the weights. The weight of the piston and the attached plate alone produces a pressure of 5 pounds, and additional weights, in sizes corresponding to pressures of 5, 10 and 20 pounds, are placed upon it to the required amount. By various combinations of the weights any pressure that is a multiple of 5 pounds may be obtained. The oil is contained within the pump at all times, eliminating the necessity of pouring it in and out before and after testing.

To place the tester in commission the chambers (A, B and C) are filled with a light mineral oil, chamber (A) being filled through the cock (D) when the handle is turned down and the plunger handle (E) is pushed clear in, and chambers (B and C) being filled through the cylinder (G) after removing the piston plate. A gauge to be tested is attached above the cock (D) by suitable connections furnished with the gauge tester. The handle of the cock being down—that is, at right angles to the supply pump (A)—the handle (E) is then pulled out until the gauge shows pressure and the tube is filled. Then by turning the handle of the cock (D) into the position shown in Fig. 2 the gauge is connected with the chamber (B). The weights are next added on the piston (F) until the desired pressure is reached. At all times during testing, the plate on the piston (F) should be kept about 2 in. above the cylinder (G) by screwing the hand wheel (H) in or out, which, of course, has no effect on the pressure, but it is not necessary to continually manipulate this plunger. It is usually sufficient to raise the table and plunger twice while testing to 500 pounds.

Before disconnecting the gauge the handle of the cock (D) is turned down and the handle (E) is pushed in. All oil is then drawn off or drained from the gauge tube into the chamber (A), preventing spilling of oil when the gauge is disconnected. The necessary wrenches, hand set, hand jack, four connection nipples and pliers accompany the instrument for connecting the gauge and adjusting it.

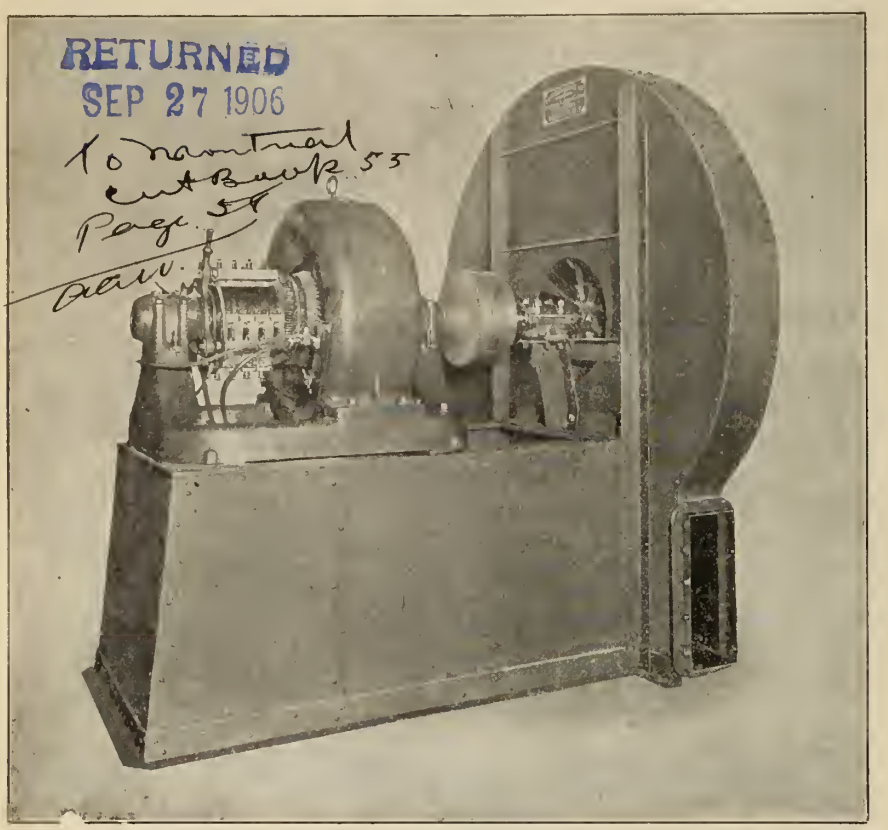


New Style of Gauge Tester.

A BLAST FAN OF UNUSUAL PROPORTIONS.

RECENTLY the Chicago, Burlington & Quincy Railway Co. were furnished with a blast fan of rather unusual proportions, designed of course to operate under special conditions. The fan was designed to furnish 7,200 cubic feet of air per minute at a pressure of ten ounces per square inch. The unusual proportions of the fan were required in order that it might be run at 830 revolutions per minute, the standard

speed of the Crocker-Wheeler motors, one of which was to operate the fan.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A Blast Fan of Unusual Proportions.

The blower is equipped with three-quarter housing, as shown in the illustration, and is provided with a blast wheel 73½ inches in diameter, and 3 inches wide at the periphery. A complete test made on the fan showed that when delivering 7,200 cubic feet of air per minute the fan was capable of maintaining a static pressure of 11.8 ounces, a good margin above the specification.

This fan was built by the Buffalo Forge Company, and in Canada the Canadian Buffalo Forge Co. are in a position to build special fans of like kind.

A NEW RADIAL DRILL AND TAPPING MACHINE.

IN the accompanying illustration is shown a new radial drill and tapping machine being placed on the market by the Newton Machine Tool Works, Philadelphia. The features of importance in this machine might be summarized as follows: The spindles are 2 13-16 in. in diameter, and the drilling spindle, which has an automatic feed of 17 inches, is driven by spiral gears, the driving shaft being back-geared through gears on the radial arm. the tapping spindle is geared from the drilling spindle with a speed reduction of 2¼ to 1; the hole having been drilled by the drilling spindle, one turn of the hand wheel will bring the tapping spindle in line with the drilled hole, after which all that is required in tapping is to draw the tapping spindle down and drop in the clutch, and since the speed reducing device is contained in the head the correct tapping speed is obtained for whatever sized drill may be used; the tap is reversed and drawn by a quick power movement; the tool is motor driven, as shown in the illustration, by a 7½ h.p. variable speed motor, with which the necessary speed variations are obtained; the arm is 6 ft. 6 in. in length, and is fitted with conical roller thrust bearings, and is provided with quick power movement; the maximum distance from the end of the base is 38in. wide and 9 ft. long.

Experience is a good thing—almost an absolute requisite to our attainment of success! Yet how often do we see men who have had the experience of a lifetime and who never made a success of anything? Experience is an excellent burnishing on top of good, sound judgment. The two go well together; the one is dependent upon the other. There may be cases where experience counts for most, but they are few, if indeed there are any. The man who lacks experience can gain it, but the man who lacks judgment can not. — The Woodworker.

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SEP 27 1906

New Radial Drill and Tapping Machine.

The Canadian National Exhibition

The Pressing Need of a New Machinery Hall at the Exhibition

THE Canadian National Exhibition is a great exhibition. Everybody says so; and everybody knows. But there is nothing so great that it might not be greater; there is no enterprise so successful that it might not be more successful; and there is no exhibition so educative to the general public that it might not be more so. Thus it is with the Canadian National Exhibition at Toronto; it is a great exhibition; it is a successful enterprise; and it is educative to the general public. But there is one feature of the Exhibition which must be given more attention than it has previously received, and this is iron-working, wood-working and power machinery. To the general public, knowing practically nothing of machinery, the Machinery Hall, as it at present exists, is of passing interest, because there they see the wheels go round; but that class of interest is of little or no use to the exhibitors. To the mechanical man, however, there is nothing of sufficient interest, outside of the few exhibits, to hold his attention for any length of time. To him the hall is educative in a very small sense of the word. Why is this? Is it the exhibitor's fault; and is it because manufacturers of these lines cannot make exhibits of interest to mechanical men? Far from it. The reason is simply this: that there are not the facilities for making the exhibits, or, in other words, the reason is the woeful inadequacy of the Machinery Hall as a Machinery Hall.

Each year some improvement has been made in the way of new buildings; but each year the Machinery Hall has been neglected. A splendid Manufacturers' Building has been erected; there has been a new Dairy Building put up; lovers of art have been favored with a new Art Building; a natural history exhibit has been added; a new Process building has been erected, which is indeed a credit to the Exhibition; and now the contracts for a new Horticultural Building are about to be let. And all this time the Machinery Hall has stood on the hill, a monument to the neglected feature of the Exhibition. The progress of Canada along machinery lines is a living protest against the scant attention which has been paid to machinery at the Exhibition. Canada is a country of natural resources, and the chief agent in the development of these resources is machinery, and yet machinery at the Exhibition is forced to take a back seat. Think of the mineral resources of Canada, and look for at the fair the means of development of the resources, and it will not be found; think of the product of the forest, and at the Exhibition look for machinery used in the manufacture of this product into commercial commodities, and one will find but a very small showing, consisting of one exhibit of saw mill machinery, cramped into too small a space, and in addition one or two machines used in planing mills. Then think of machine tools, first essential of all iron working industries of any kind, and one will find that not a single manufacturer is exhibiting, and that the number of tools exhibited by machinery dealers is very limited, because of lack of space. Power machinery is better represented than any other class, but even here the exhibits, taken as a whole, are not representative, there being lacking adequate representation of one of the most important of prime movers, the steam engine.

Whether a new Machinery Hall should, or should not, have been built before some of the new buildings which have already been erected, or are being now considered, is a debatable question, but that now is a dead issue and need not be touched upon. At present practically all who would pretend to discuss the question are firm in the belief that a new hall is needed, and needed badly. And a new hall will be built, but the question now will be one of the time of building, and the cost. Now that those interested have waited so long it is in keeping that they should advocate strongly the erection of a building which will be a Machinery Hall in the true sense of the word. The first consideration will be that of the site, in the vicinity of the railways, so that sidings from both the C.P.R. and G.T.R. can be obtained. The second consideration will be that of size and plan. The size must be such as to include all the machinery exhibits now on the grounds, and also those of firms who would exhibit if space and machinery handling facilities were available. This year some of the most interesting machinery exhibits were to be found outside of the Machinery Hall, some in the Process Building and some in tents. This certainly should not be. The size of the building should also be such as to provide adequate space for each exhibitor, so that he will not be handicapped in making a suitable display of his goods, as nearly all the machinery exhibitors are at the present time. Then, too, there should be space for purely educative exhibits, the expense of which the Exhibition itself might have to stand. The shape of the building should be such as to provide for extensions, and at the same time not occupy too much space relative to the floor space of the building, and the shape should also be such as to provide for the proper handling of the machinery, and also for the classification of exhibits. The third consideration will be that of handling the machinery, and in this respect a siding into the building, electric traveling cranes and jib cranes are essential features. Heavy machinery cannot be handled to advantage without these modern conveniences. Only this year two firms were prevented from adding to their exhibits some very interesting but heavy machines by the lack of these facilities. The manner at present adopted of handling the machinery at the hall is certainly unsuited to the requirements.

The whole issue may be summed up in the statement that a new modern Machinery Hall is needed at the Exhibition, and this hall should be made of such decided interest to mechanical men that it will be a good investment for manufacturers and dealers in all lines of machinery and machinery supplies to not only occupy space but to go to sufficient expense to make their exhibit of decided educative value. The first phase of this question which will have to be considered by the Exhibition aulay. And in considering expense, and they must not expect to obtain a suitable building without considerable outlay. And in considering expense, aod returns for that expense, the question should be looked at from all points of view, and if this is done this conclusion will probably be reached, namely, that a liberal policy is the best policy.

As conclusive evidence of the widespread interest which this question of a new Machinery Hall has evoked among manufacturers, and others, the following opinions are printed, which were obtained by Canadian Machinery through letters sent out or in interviews:

H. W. Petrie.—Is very desirous of seeing a new and up-to-date Machinery Hall erected. He thinks that more space is required and better equipment for the handling of machinery, and that the location of the present building is out of the way, and that it is very improperly ventilated.

Canada Foundry Co.—Mr. H. O. Edwards has taken very considerable interest in the erection of the new Machinery Hall at the Exhibition, and in connection with Mr. H. G. Nichols, who is chairman of the Machinery Hall committee, has originated plans and speci-

fications for a hall, and have made estimates as to its cost. The style of building which they would suggest consists of four wings radiating from a centre, thus forming a cross. These wings would be 200 feet long by 80 feet wide. If at present all four wings were not required, three might be built and space left for the fourth. The location of this building would be arranged so that the main entrance to the southern wing would be directly opposite the northern entrance to the Process Building. Passing the entrance of the northern wing would be a railway siding. The building would be equipped with an electric crane running the entire length of the northern and southern wings, arranged so that it could pick up machinery from cars on the siding and convey it into the building. The eastern and western wings would be served by hand cranes, and where they were required jib cranes might be installed. The exhibits should be classified, and a department in the building set aside for each class. If a new building were erected the Canada Foundry Co., and the Canadian General Electric Co., would make a much larger and more elaborate exhibit even than they do at present.

The Canadian Fairbanks Co. — Mr. Brittain strongly advocates the building of a new Machinery Hall at the Exhibition equipped with the proper facilities for handling machinery, this equipment including electric cranes and jib cranes. He thinks that the machinery exhibits should be classified, and as a point in favor of this spoke of the unsystematic way in which gas and gasoline engines were exhibited at the Exhibition this year. He thinks that there should be a section devoted to gas and gasoline engines in the new hall. The Machinery Hall, he thinks, should have been given equal consideration with the new Process Building, and as a feature of the Exhibition it would have been at least equal in value.

The A. R. Williams Machinery Co.—A modern Machinery Hall should be built having all the necessary appliances for the adequate handling of machinery. The shafting, if possible, should be run under the floor so that the machines could be belted up from below, thus doing away with dangerous counter shafting and belting in the exhibit. If the new Machinery Hall were built it would be one of the most attractive features at the Exhibition, and in that case we would be in a position to use at least double the space we have at present. We would suggest that the Exhibition authorities induce the railway companies and locomotive works to exhibit locomotives.

The Consolidated Electric Co.—There is certainly a very great need of a new Machinery Hall at the Exhibition, with modern equipment and greatly increased space, having a more prominent position on the grounds. The Machinery Hall is of great importance to the Exhibition, and should be given consideration accordingly. If a new hall were built we would be in a position to take at least double the space which we have at present, and would in that case make a much more elaborate display; indeed we would build machines especially for the Exhibition.

The Economic Power, Light & Heat Supply Co.—We would like to obtain space in a new Machinery Hall.

London Machine Tool Co.—A new Machinery Hall is needed very badly, and if one were built we should be glad to use space.

Goold, Shapley & Muir Co.—In reference to placing machinery in a modern building at the Industrial Exhibition, we quite agree with your idea that a great improvement could be made by grading all the different lines to exhibit, and place them in as close proximity as possible. No doubt thousands of visitors come to inspect a certain line of machines that they are interested in, and to make fair comparisons it is impossible for them to do so intelligently if they have to run from one building to the other, the same as they have had to in our line of exhibit, viz., gas and gasoline engines. We trust that the stand you are taking in this matter will have influence from the industrial board and bring about this much needed reform.

The Dodge Manufacturing Co. — You have asked us our opinion as to the requirements of a new Machinery Hall at Industrial Exhibition grounds. In this connection we would say that we have been of the opinion for some time that the Machinery Hall was entirely inadequate. If we are to expect the machinery builders of this country to exhibit we must provide ample facilities, and this means in the first place a building so situated and designed as to permit of a railway siding running completely through it; next it must be of ample proportions, and so constructed and designed as to accommodate adequate over-head traveling crane facilities. It should be possible for such people as the John Bertram Co., Dundas, to ship a large machine tool into the building on a flat car, and the over-head crane facilities should be there to lift this tool off and lay it down in place at the company's exhibit. This also means that the floor of such a building should be of such a character as would permit of sustaining heavy loads. Such a building for the requirements might easily be six to eight hundred feet long by at least two hundred feet wide, steel construction, and would no doubt cost considerable money; but until we have something such as here described we will hardly be able to say that we have a modern Machinery Hall, nor need we expect machinery builders to exhibit.

The Smart-Turner Machine Co. — We think the time has come when the Canadian National Exhibition would be materially benefited by a suitable Machinery Hall, which would be properly equipped for exhibiting heavy machinery, and so arranged that piping could be laid under the floor so as to enable gasoline engines in the centre aisle to be operated without undue expense to the exhibitor.

J. N. Tallman & Sons.—We are very much in favor of having the National Exhibition Association put up a new Machinery Hall. The writer has been going down there for some years, and might say that after being there in the building for two weeks, a person is ready for a couple of weeks holiday to recuperate. The present building does not seem to be ventilated enough and consequently the place is hot and stuffy. We think it would be a good plan to have a new building so that the regular exhibitors could get a permanent spot and fix it up, so that they could use it from year to year. As it is now the majority of us have to shift around each year, and it does not pay to make an attractive exhibit for only one year.

I. E. Shantz & Co. — We are fully agreed with you regarding inadequate accommodation in the Machinery Hall. We might also say that a petition was circulated, and every exhibitor and representative signed it. We hope that a joint effort may induce the board to make the necessary changes.

The Defiance Iron Works Co.—We are quite in accord with your views regarding the erection of a Machinery Hall such as you describe, where the exhibits of machinery could be concentrated and made more attractive and valuable to exhibitors.

The John Bertram & Sons Co.—About fifteen years ago we complained very bitterly of the accommodation granted machinery men at the Toronto exhibition in the present Machinery Hall, and for this reason we have entirely discontinued exhibiting our machinery there. It certainly is of no interest to anyone to go to the expense of getting up ten or fifteen thousand dollars' worth of machine tools, paying freight to Toronto, handling everything over that rotten platform from the railway siding to the building, and going to the expense of belting and arranging to set machinery in motion, under existing circumstances. We have simply got so tired of calling their attention to this fact that we finally decided to cut the exhibition out, so far as we are concerned, for all time to come. If a modern Machinery Hall

were erected, with a railway siding directly into the building, and means of handling machinery provided, we would be then in a fit mood to reconsider, and again patronize the exhibition. You have our best wishes for success in this matter.

The E. Long Manufacturing Co. — Regarding having the Machinery Hall replaced, we have no hesitation whatever in saying that it is certainly badly needed. We consider the accommodation as it is at present is anything but satisfactory, space being very limited, and facilities for handling machinery very poor. We might say here for your information that we tried very early in the season to secure increased space for our exhibit, but were unable to do so, the space being so very limited. We trust you will be successful in the efforts you are putting forth.

The Waterous Engine Works Co.—Regarding the inadequacy of the Machinery Hall of the Canadian National Exhibition, we think your attitude in connection with this building is absolutely correct; we not only think that the building should be larger but think it should contain equipment for the easy handling of heavy machinery, and further, it should have sanitary arrangements for the accommodation of the exhibitors at least.

Clark-Demill Co.—It would certainly be a great improvement to have a modern Machinery Hall in place of the present out-of-date building used for machinery exhibits. We are satisfied it would work to the benefit of the exhibition and also the exhibitors, as the present building is certainly not suitable to show goods in, and your sentiments are ours. We wish you every success.

Canadian McVicker Engine Co. — We believe that your idea of equipping a building with traveling cranes, etc., is the correct one and as the exhibition is a permanent one we would certainly recommend that a good Machinery Hall be built of the latest design and that there be installed in same the latest type of machinery for handling heavy weight.

Toronto & Hamilton Electric Co. — We are pleased to see that you are taking up the matter of accommodation for exhibits and exhibitors in the Machinery Hall at the National Exhibition. We cannot too strongly emphasize the necessity of there being built an up-to-date building into which it is possible to unload heavy machinery without danger to life, to say nothing of the machinery and floors. It was only the other day that the writer saw a wagon loaded with machinery being pulled out of the building by hand when one of the front wheels broke through the 1½-inch flooring of the hall and the other threatened to do the same. Moreover, the sanitary conditions existing, lack of ventilation, etc., are a disgrace to the authorities of the concern. We would suggest that a new hall fitted with cranes and designed to carry heavy machinery should be built. In this hall running shafting with bearings properly spaced (those in the present hall being some 16 feet apart) should be provided in convenient locations, and if possible some convenient method of concealing the wiring used in connection with electrical exhibits should be adopted. We believe also that you do well to mention the confinement of the exhibits to things mechanical, as with the present arrangement no one unacquainted with the building can find what he looks for, no official guide to exhibitors being published, we believe.

Exhibit of Pneumatic Tools.

The only exhibit of pneumatic tools at the Exhibition was that of the Canadian Pneumatic Tool Co., made by their sales agents, N. J. Holden Co., Limited, Montreal. This was the first time that this company had exhibited, and the style of the exhibit this year was certainly a credit to them. Not only was there displayed a large stock of pneumatic tools of all kinds, but there were also practical demonstrations of the operation of pneumatic and electric drills, drilling steel plates. The compressed air for the operation of the pneumatic drills was supplied by a type G. belt-driven compressor, governed so as to automatically maintain a constant pressure in the receiver. The compressor is designed for a pressure of 100 lbs. per square inch, although at the Exhibition it was being operated at less than half that pressure. The electric drills were operated on a 110 volt D.C. circuit.

The exhibit of pneumatic tools, besides the drills, included pneumatic hammers, chippers, riveters, etc., and sand rammers. But the two chief features of the exhibit were the "Little

Canadian National Exhibition—Canadian Pneumatic Tool Exhibit.

Giant" air drills and the Duntley electric drills. The improved "Little Giant" drills were shown, which drills are equipped with simple Corliss valve gear, which has been used considerably in England for this class of work. The valve is driven by tongue and groove in the head in the same way as in Corliss steam engine. This valve is reversible at the handle. The air-cooled Duntley electric drills are adaptable to a wide range of usefulness, because of the handiness of electric power. The motors running the drill spindle are wound for either 110 or 220 volts, and thus the drill can be run wherever an incandescent lighting system is available. A test of one of these drills made recently outside the establishment of the N. J. Holden Co., in Montreal, before a number of interested persons, shows the quickness with which these drills do their work, and the makers claim them to be very economical in power.

This exhibit was quite an educative one for the general public, and at times there was considerable speculation as to what manner of things those might be among the uninitiated in mechanical subjects.

Exhibit of Pipe-Threading Machine.

A very interesting exhibit of pipe threading machines was made by I. E. Shantz & Co., Berlin, Ont., in the Machinery Hall. This firm showed a lathe type of pipe-threading machine, which has new and interesting features, they being the only manufacturers of this style of pipe-threading machine in Canada. The machine was designed by W. R. Hunter, who has had a number of years experience with the Borden Co., and who is now a member of the firm of I. E. Shantz & Co. A valuable feature is that changes of speed can be made while the machine is in operation. It is fitted with the Borden solid adjustable dies. Besides this machine there was a full line Borden hand-power pipe-threading machines exhibited, as well as pipe stocks and dies. The I. E. Shantz Co. are sole manufacturing and selling agents for the Borden Co

The T. & H. Electric Co.

The Toronto & Hamilton Electric Co. made their usual handsome exhibit of electrical machines. These included both direct current and alternating current machines, there being three D.C. machines and 5 induction motors; they also had on exhibit one of their selector switches.

The Smart-Turner Machinery Co., Hamilton.

This firm exhibited quite a complete line of their duplex and other pumps; they also showed a marine engine with shaft and propeller. The exhibit had a very neat and attractive appearance.

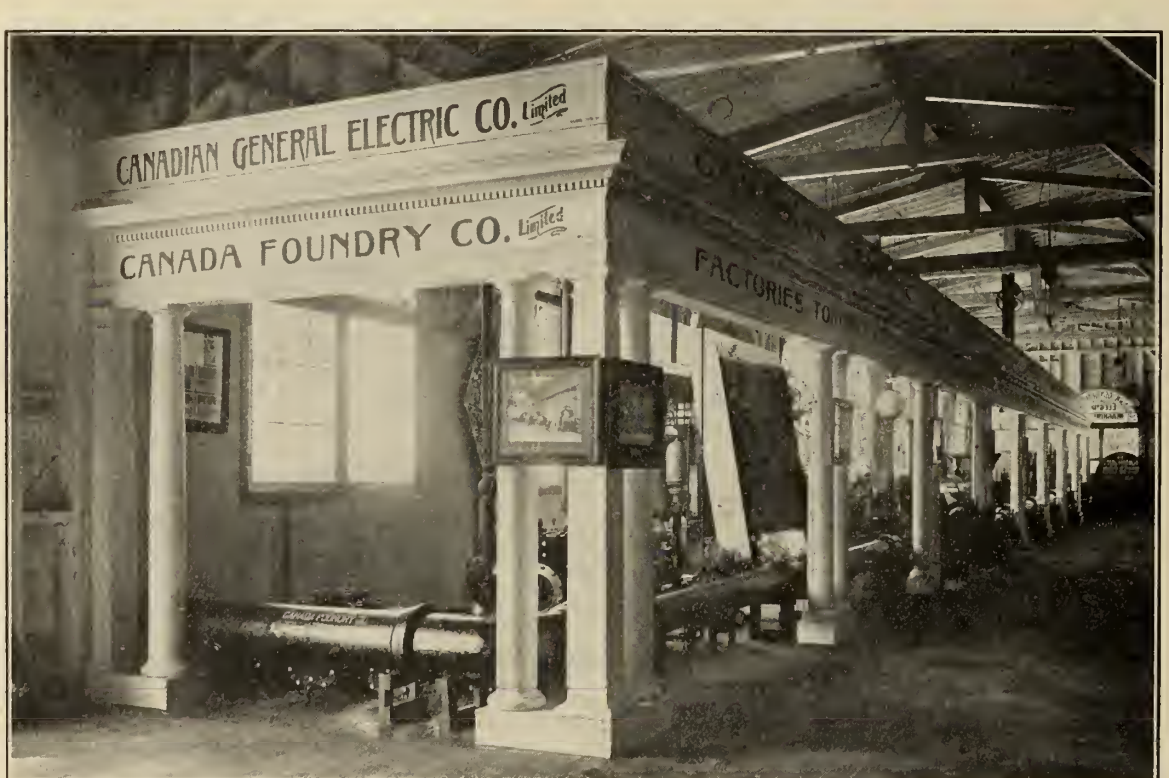
A Saw Mill Machinery Exhibit.

The E. Long Mfg. Co., Orillia, made their usual exhibit of saw mill machinery in the Machinery Hall. The company showed their No. 0 carriage, which is of interest to small lumber manufacturers; and also sections of larger carriages showing different sizes of double-acting set works. They also exhibited a combination lathe machine and bolter suitable for work where it is desired to make lath from slabs.

Canada Foundry Exhibit.

If one were to judge the value of an exhibit by its weight that of the Canada Foundry Co. would be ahead of all, as this enterprising firm had on exhibition in Machinery Hall over 80 tons of was an ore crusher weighing 10 tons; their manufactures. The largest piece is an ore crusher weighing 10 tons, and the smallest a headless set screw weighing 1-10 of an ounce. To show that even larger pieces are made in their large Davenport works, there were shown photographs of locomotives in use by both the C.P.R. and James Bay Railway, as well as some 70-ton steam shovels photographed at work on the James Bay Railway near Aurora. A steel railway bridge on the Guelph and Goderich Railway is shown, one of the spans being put in position by a large steam derrick made by this firm.

The working exhibit consisted of a 500 gallon underwriters pump operating a miniature waterfall. Side by side with this pump was shown the smallest du-



Canadian National Exhibition—Canada Foundry Exhibit.

ETURNED
SEP 28 1905
To Dunn
Book 55
Page 64

plex pump used for feeding steam boilres.

The exhibit was surrounded by a course of cast iron water pipe of various sizes, all connected together and forming a unique and practical application of many special castings used in connection with a waterworks system.

Heald Machine Co. Grinder.

In the space of the Canada Cycle & Motor Co. was shown a Heald grinder made by the Heald Machine Co., Worcester, Mass., on which are ground the piston rings for the gasoline engines of the Canada Cycle & Motor Co. The grinder is provided with an electromagnetic chuck, and it has a micrometer attachment by the aid of which a variation of 1.1000 of an inch can be secured.

Stevens' Tool Grinder.

There was exhibited in the space of the Canada Cycle & Motor Co. one of the standard tool grinders made by the Stevens Co., Galt. The table of the grinder is adjusted in two directions, and has in addition a universal adjustment through a number of degrees.

The Jones and Moore Exhibit.

The Jones & Moore Electric Co., Toronto, had this year an enviable position in Machinery Hall, their space having been changed since last year. They now occupy an end space in the middle aisle and had a very complete exhibit of their machines, both direct and alternating current. Two large D. C. generators supplied power for lighting of several buildings throughout the grounds and also several exhibits in the Machinery Hall. The line of induction motors exhibited was very complete, there being 11 machines ranging from 1 h.p. to 32 h.p. A very attractive feature of the exhibit was the lighting, the space being surrounded by a string of various colored incandescent lamps.

The Garlock Packing Co.

The Garlock Packing Co. had their usual exhibit in the Machinery Hall of packing of all kinds. The exhibit consisted of an attractive booth in which the packing is shown off.

The Dominion Belting Co.

As usual the Dominion Belting Co., Hamilton, had their exhibit of Maple Leaf belting in the Machinery Hall, the exhibit consisting of three large pyramids of belting. They also exhibited their belt dressing.

Fox Bearing.

The Fox Bearings, Limited, of 205 Adelaide St. west, Toronto, occupied a Adelaide street west, Toronto, occupy a booth on the upper storey of the Transportation Building, where Mr. Fox explained its advantages. Amongst other things it can be placed on a shaft without taking off a pulley or hanger. These bearings have been installed and are now running in different places showing what they are capable of doing.

The Canada Metal Co.

The Canada Metal Co., Toronto, manufacturers of babbit metal and lead pipe, made an extensive display of lead traps and bends. This is now one of their leading lines. They are prepared to supply the trade with any size or shape in traps and bends required.

The Canadian National Exhibition Exhibit Canada Metal Co.

The exhibit also included the various sizes of lead pipe made by the company, who carry a very large range of pipe, these being from 1-16 of an inch to 8 inches in diameter. Their Imperial genuine babbit metal is creating a great deal of interest. This is the highest grade babbit metal made. It is in use on large steam engines, dynamos and high-duty machinery. This metal the company guarantees to give satisfaction. They also showed in connection with this babbit, other alloys that are giving satisfaction wherever placed

There was also to be seen plumbers' wiping solder, all grades and shapes; bar lead, block lead, bar tin, battery zinc, fuse wire and all newspaper metals, pig lead and ingot copper.

The general manager, Mr. W. G. Harris, endeavored to show the trade through their exhibit most all goods manufactured by the company, and the exhibit, as can be seen by the illustration, was a very creditable one.

D. K. McLaren.

This company made their usual exhibit of different kinds of belting including leather and rubber belting, and they also showed a line of mill supplies.

A. R. Williams Machinery Exhibit.

One of the most prominent spaces in the Machinery Hall was that occupied by the A. R. Williams Machinery Co. Being directly opposite the main entrance the exhibit was sure to be seen by all entering the hall, and the style of the exhibit this year was such as to command the attention of all interested in machinery, and to awaken the admiration of all, whether directly interested or not. A feature of the exhibit which contributed largely to the effectiveness of the exhibit was the operating of practically all the machines.

The exhibit was a very complete one, representing as it did iron and wood working machinery, powerhouse machinery and engineers', machinists' and mill supplies. Ironworking machinery was represented by a radial drill, a a drill, an automatic gear cutter, an engine lathe, a shaper, a patent safety press, and woodworking machinery was represented by a surfacer and buzz planer.

The radial drill exhibited was a Fostick machine, 48 in., equipped with a new belt-shifting device and new change feed device. The automatic tapping attachment is also a feature. The bolt cutter was a standard McGregor-Gourley machine; the pipe-threading and cutting off machine was one of the R. McDougall standard makes, and the drill was one of the original W. F. & John Barnes tools, 20 in. The gear cutter was a fully automatic tool of handsome appearance, made by Louis Besse, Paris, France. The lathe and shaper were the product of the American Tool Works Co., and both of them being in operation cutting metal, attracted considerable attention. The lathe was one of the up-to-date geared-head lathes of this company, giving 54 changes of speed without stopping the lathe. Demonstrations of the working of the lathe were made with high speed steel tools. The shaper was one of the standard American make, having an 18 in. stroke and operating on cast iron.

A machine which attracted considerable attention was the patent safety press recently placed upon the market by J. B. Hall, Toronto. The novel features of the press are two, one being the safety clutch which, when thrown in, requires that the foot lever be pressed for each stroke of the press, and the other being the swinging of the body of the press from the same centre as the pulley, thus allowing the press to be placed at any angle without in any way changing the drive.

Whenever the Harper eclipse 30-in. single surfacer was put into operation there gathered at once an interested crowd. This surfacer is equipped with a sectional feed roll and chip breaker. The other representative of woodworking machinery was the 12-in. standard buzz planer, made by J. Ballantyne & Son. On this planer was demonstrated the uses of the Jones safety guard, designed to prevent accident to the operator in feeding the material across the knives. This safety guard is made by J. M. Jones, 22 King William street, Hamilton.

Canadian National Exhibition—A. R. Williams' Exhibit.

Representing power house supplies was exhibited a standard Martin duplex pump, made by the Martin Pump & Machine Co., as well as engineers' supplies. This exhibit was completed by a handsome display of engineers', machinists' and mill supplies, which included two pyramids of Reeves' pulleys, steam gauges, valves, oil cans, drill

chucks, chucks, machinists' hammers and vices.

The "King Edward" Machines.

The Consolidated Electric Co., Yonge street, Toronto, made their usual complete and attractive exhibit of "King Edward" dynamos and motors. These included both direct current and alternating current machines, their new style of induction motor being much in evidence. The exhibit was lighted with various colored incandescent lamps supplied with power from a "King Edward" dynamo, run from one of the lines of shafting.

The Babcocks & Wilcox Boiler.

Babcocks & Wilcox exhibited one of their standard water tube boilers equipped with a superheater.

Gould, Shapley & Muir Engine.

The attractiveness of the exhibit of Gould, Shapley & Muir, Brantford, has been much increased by the building of a canopy over their space. They showed a very complete line of their gas and gasoline engines in large and small sizes, and also a line of oil pumps. Their "Ideal" automatic concrete mixer did attract considerable attention, as did also their "Ideal" portable gasoline engine.

Canadian Bearings, Limited.

The Wright taper roller bearings were exhibited in the Machinery Hall by the Canadian Bearings, Limited, Hamilton. This firm also showed a sensitive drill which they manufacture in addition to the roller bearings.

Wettlaufer Bros. & Sons, Limited, Stratford.

An exhibit of lightning cement pressed brick machines and concrete mixers was made by this firm in the Process Building.

Reversible Gasoline Engines.

Something new to the Canadian market is the type of engine shown by the Miller Reversible Gasoline Engine Co. of Toronto. The exhibit was looked after by Mr. M. J. Miller, where four engines were shown. There was one each of 1, 2 and 5 h.p. marine type and one 3 h.p. stationary. These engines are equipped with a reversing lever which makes it run both ways, enabling the use of a solid propeller wheel. A float feed carburetor is used which works automatically. They are built in sizes from 1 to 25 h.p. for the marine engine and 3 to 35 h.p. for the stationary.

Gasoline Pumping Plants.

In the Montcith-Nixon Co.'s exhibit in the Process Building was shown adaptability of the gasoline engine for small isolated pumping plants. A 2 h.p. International Harvester Co.'s engine was shown running a small pump. This is a particularly desirable outfit for pumping water into an upper tank or reservoir either for manufacture or for a hotel or Summer resort.

The James Morrison Brass Exhibit.

For brilliancy and artistic effect, the brass and plumbing goods exhibit of the James Morrison Brass Mfg. Co. could have no equal. The lighting fixtures contributed very largely in the production of this brilliant effect, but the highly-polished brass goods reflected the rays of light from the numerous electric lights, and thus also contributed their share towards the production of the brilliant effect. The display of brass goods included all kinds of engineering supplies, as well as other lines; and these supplies included injectors, valves of all kinds, both brass and cast iron, steam gauges, steam engine indicators, steam whistles of various kinds and sizes, revolution counters, oil cups, water gauges, locomotive bells, etc.

One of the chief features of the exhibit was the display stand of J.M.T. valves of all kinds, which had a very handsome appearance. Another important feature was the improved Thompson steam engine indicator, which is provided with a reducing motion mechanism gotten up by this firm. The lines of steam gauges handled by the firm were handsomely displayed on the real wall of the space, together with revolution counters and other engineers' supplies.

Of late years this company have made great strides in the manufacture of artistic gas and electric fixtures, so that their display of these goods included many fixtures which compare very favorably for beauty in design and workmanship with the finest of imported lines.

Carbon Paint.

On the second storey of the Transportation Building Depew's carbon paint was shown. The works of this company are situated on Queen street west, Toronto. This paint is suitable for machinery of all kinds, brick, metallic or other exposed surfaces.

The Canadian National Exhibition—James Morrison Brass Exhibit.

The Pendrith Machinery Co.

The Pendrith Machinery Co., Toronto, had two exhibits, one in the Machinery Hall and one in the Process Building. In the Process Building the company gave a practical demonstration of the operation of their bakers' machinery; and in the Machinery Hall, besides exhibiting bakers' machinery, they showed a line of tool grinders.

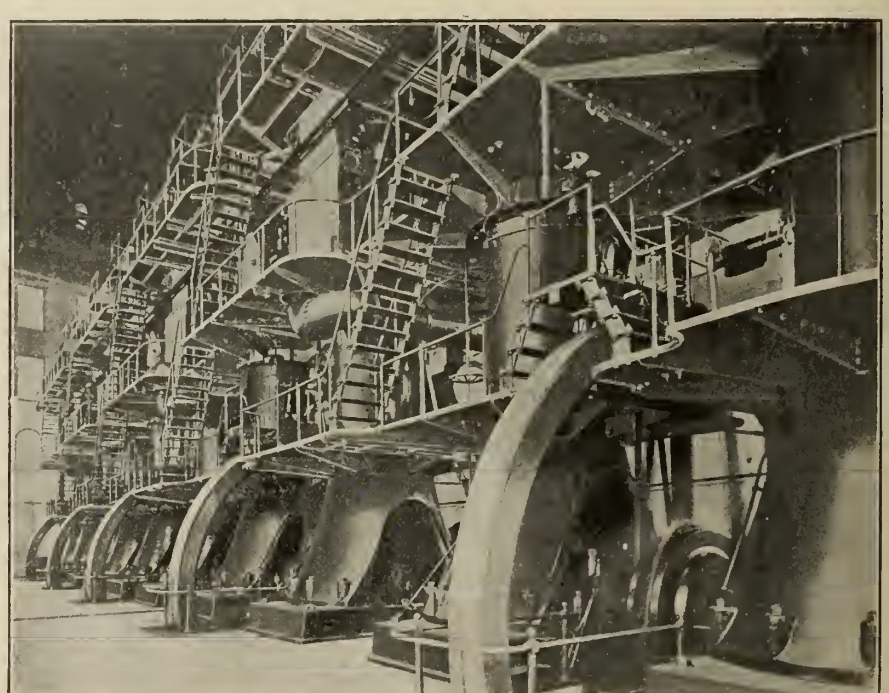
Power and Transmission

Steam Gas Electricity Compressed Air Water

ALLIS-CHALMERS BLOWING ENGINES.

THE accompanying illustration shows the most recent development of the Allis-Chalmers blowing engine. The history of the development of this engine is a record of an achievement of which the Allis-Chalmers Co. might well be proud. This type of engine has been designed by Mr. Edwin Reynolds, and the first work on it was done in the early eighties. He has practically revolutionized the construction of these engines, so that the long cross-head type of engine, the compound steeple blowing engine, and their compound horizontal unit have come to be acknowledged as embodying the standards of blowing engine practice. The demand which these engines have had from the large iron and steel companies in the United States is a good proof of their reliability and economy.

Some statistics in reference to these engines will indicate the tremendous aggregate of power which iron and steel companies utilize in this way for the production of their output. The total normal output of air per minute from the air cylinders of Allis-Chalmers blowing engines used in the United States by iron and steel companies is approximately 2,000,000 cubic feet. The enormity of this volume can be better appreciated in the statement that it represents a tube of air having a cross section of one foot and a length of 380 miles. The aggregate horse power of the steam cylinders of the same engines (under normal conditions) is over 50,000.



Allis-Chalmers Blowing Engines.

ADDITION TO THE OTTAWA ELECTRIC LIGHT PLANT.

A POWER installation of considerable interest which has recently been installed is an addition to the equipment of the steam power station of the Ottawa Electric Co. This addition consists of a Westinghouse terbo-generator of 1,500 k.w. capacity. This unit was installed to serve as an auxiliary to their present water power equipment, and to take the peak of their lighting load during the Winter months when water is low. The complete equipment consists of three 400 h.p. Babcock & Wilcox water tube boilers, a 2,250 b.h.p. Westinghouse-Parsons turbine direct connected to a Westinghouse rotary field, two-phase generator of the above named capacity, and a barometric condenser with dry air pump, supplied by the Jno. McDougall Caledonia Iron Works Co. The steam pressure used is 150 lbs. The boilers are not equipped with superheaters, but to insure dry steam being supplied to the turbine the steam trap is placed directly under the main inlet valve of the turbine.

A short description of the steam turbine may be of interest. It is one of the Westinghouse-Parsons standard type. An interesting feature is the provision of a secondary governor valve which is automatically opened to allow the passage of high pressure steam to the low pressure end of the turbine, by which means a full load may be developed while running noncondensing, or a 50 per cent. overload while running condensing. There is also an auxiliary governor operating an automatic cut-off valve which closes off the steam supply in case of the turbine attaining a greater speed than safety would allow. Within the load limits of the turbine the governor is adjusted to regulate within 4 per cent. of average speed. The guaranteed steam consumption of this turbine is 15.3 lbs. per b.h.p. at full load.

THE MILLER IMPROVED GAS ENGINE.

THE accompanying illustration is of the Miller improved gas engine as recently placed on the market by the Miller Improved Gas Engine Co., Springfield, O. These are heavy duty engines of the four-cycle type, built in sizes 50, 75, 100 and 150 h.p. The engine is built up by placing two beds side by side and yoking them together. The method of governing is by throttling, and the method of ignition is by the jump spark system. The governor is a small centrifugal one controlling the action of the throttling piston by regulating the supply of air to the vacuum pump. The current for the electric spark is supplied by a storage battery, and the point of ignition can be changed as desired while the engine is in motion.

The valves, both inlet and exhaust, are poppet valves, the inlet being operated by the suction stroke of the engine, while the exhaust are mechanically operated, being, however, balanced to prevent undue strain on the mechanism operating them. The action of the exhaust valves are controlled by dash pots to prevent undue hammering. The mixing chamber is situated beneath the throttling chamber, which is located between the two inlet chambers, and is equipped with a mixing valve through which any desired proportion of mixture can be obtained by the operation of a small lever.

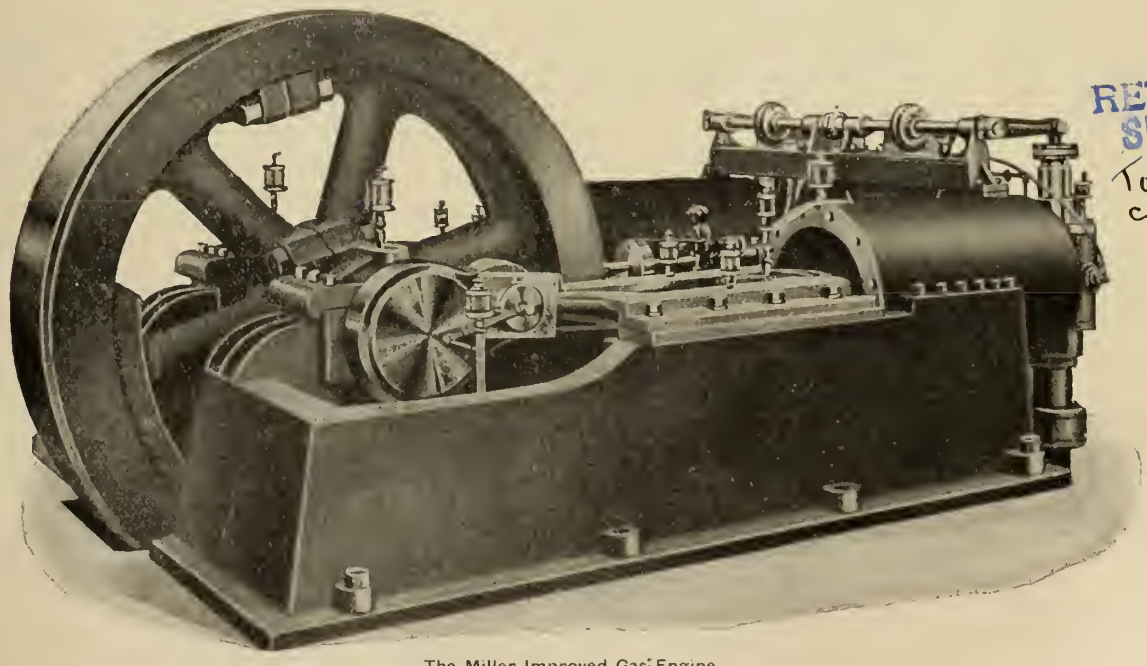
The cylinders and water jackets are separate castings secured to the beds by cap screws. The pistons are provided with four snap rings each. Cross-heads and guides are used in the engines, the shoes of the cross-heads sliding between upper and lower guides. The shoes are swivelled on the ends of the cross-head wrist pins. The bearings are babbit lined and are peaned to compensate for shrinkage, after which they are bored by means of a boring bar through the two boxes after the beds are lined up on the erecting floor. The fly wheels are made in halves, and bolted and keyed to the shafts.

THE IMPERIAL GAS ENGINE.

THE accompanying illustration is of the Imperial gas engine, sold in Canada by H. W. Petrie, Toronto, and which is built especially for him. Complete combustion of fuel, as was evidenced by its exhausting into the building without the usual accompanying odors; the simple method of governing, whereby any speed from 100 to 600 revolutions per minute can be obtained while the engine is in operation; and its simplicity of construction and smooth running qualities.

The Imperial Engine.

The vaporizer is a solid brass casting, the quantity of gasoline being controlled by a screw on the top. A point of interest about the connecting rod is that the upper end is fitted with phospher bronze boxing, while in the lower end babbitt metal is used. The method of lubrication is by the splash oil system, and also by sight feed lubricators. The jump spark system of ignition is used on these engines. The governing was spoken of before, and is of the hit and miss type. These engines are guaranteed for one year, and within that time any defective parts will be repaired or replaced, providing they are not caused by misuse or neglect.


The Miller Improved Gas Engine.

This engine was exhibited at the exhibition, and there attracted considerable attention because of one or two features which it possesses. These features are:

NEW ELECTRIC RAILWAYS.

ELECTRIC railway extensions of importance are being projected in the lower Fraser Valley and some of them will, if installed, mark the inauguration of long-distance electric lines in the province. The most important is the projected line up the Fraser to Chilliwack, a distance of 60 miles or more. This line will be on the south side of the river and will run all the way through a good farming and ranching district, which indeed is the general character of the whole section between the Fraser River and the international boundary as far east as Chilliwack. There are a number of prosperous settlements there already, but absence of any practical means of transportation, with exception of the river steamers, has always been a drawback to large settlements and to development of land.

The other projected line is from Eburne to New Westminster, on the north side of the Fraser River. This undertaking will be carried out by the C.P.R. which has a charter for a line, which will run either on the mainland from Royal city down the river or else on Lulu Island, practically to the seacoast, a distance of some fifteen miles.

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SEP 27 1906
To U
cut Book 55
Page 60
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Industrial Progress

MACHINERY AND INDUSTRIAL NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired

The Galt Mallcable Iron Works have started operations.

A new furniture factory is to be erected in Waterloo, Ont.

Barber & Co., Vancouver, are erecting a new mattress factory.

A board of trade has been organized at North Vancouver, B.C.

Barthelmes & Co. will erect a piano action factory in Toronto.

A new saw mill is to be erected near the head of False Creek, B.C.

The St. John Lumber Co., St. John, N.B., will erect new saw mills.

The Government are installing new machinery in the mint at Ottawa.

The Verity Plow Co., Brantford, will build an extension to their factory.

The Prince Edward Island Railway are erecting a car shop at Charlottetown.

The C.P.R. have commenced extensive additions to their docks at Port Arthur.

The Hamilton Distillery Co. will erect a seven storey building to cost $26,000.

The C.P.R. are about to erect a new saw mill at Holsmer near Fernie, B.C.

The planing mill of Alderman Gerry, London, Ont., has been destroyed by fire.

The Canada Cycle & Motor Company will extend their plant at Toronto Junction.

The Dowswell Mfg. Co. will build a warehouse to cost $3,000 in Leamington, Ont.

Gowans, Kent & Co., Toronto, are erecting a large factory on King street, west.

Spout, Waldron & Co., Minneapolis, will build a flour mill at Lethbridge, Alta.

A company has been organized in Regina for the manufacture of sand-lime brick.

Shurley & Dietrich, Galt, have under way the construction of a large new factory.

The linseed oil plant of the Sherwin Williams Co., Montreal, is now nearly completed.

The Massey-Harris Co., are erecting a new storage building in Brantford to cost $3,000.

A large new commercial block will be built by J. W. Horn in Vancouver, to cost $25,000.

The Great Lakes Navigation Company will build a $50,000 shipbuilding plant at Fort William.

The sawmills of the W. J. Hesson Company at the Soo were destroyed by fire. Loss $10,000.

The Waterloo Threshing Machine Co. will erect a warehouse and repair shop at Portage la Prairie.

R. C. Fuller & Co., chemists, Amherst, N.S., are making improvements to their works to cost $2,000.

It is expected that an oil refinery will be established at Chatham, Ont., within a very short time.

McLean Bros., Vancouver, are to build a large saw mill near the mouth of the Fraser River.

The by-law to give a loan of $25,000 to the Canadian Bearing Co. was passed by Woodstock ratepayers.

The Lethbridge Coal Mines Co., Lethbridge, Alta., will improve their plant to the extent of $75,000.

Schram & Brown have commenced the manufacture of cement brick by a new process at Medicine Hat.

The ratepayers of Calgary will vote on a by-law to raise another $10,000 for the municipal power plant.

It is reported that a valuable discovery of copper has been made near the old Bruce Mines in Ontario.

The Nelson Iron Works, Nelson, B.C., will build a large new works to keep up with their increasing orders.

Waterloo, Ont., has carried a by-law to spend $5,000 for a third storage tank for their waterworks system.

The foundry of F. E. Middleton, Ridgetown, was badly damaged by fire. It was covered by insurance.

Net earnings of the Granby smelters during the fiscal year ending June 30, 1906, amounted to $1,800,000.

The new smelting plant of the British Columbia Copper Co., Limited, Phoenix, B.C., is just about completed.

The building of the plant of the Montreal Smelting & Refining Co., at North Bay, is now well under way.

D. Drysdale will erect a new saw mill on Queen Charlotte Island, with a capacity of 150,000 feet per day.

The Village of Hastings will vote to grant a bonus of $5,000 to the Peterborough Boiler & Radiator Co.

The Massey-Harris Co. are making an extension to their storage building in Brantford, to cost about $20,000.

The French firm of St. Frere are considering the establishment of a plant in Canada for the manufacture of bags.

A new concentrator has been installed by the Montezuma Mining & Milling Co., Kaslo, B.C., at a cost of $45,000.

The Canadian Ship Building Co., Toronto, are negotiating for property in order that they may extend their plant.

W. D. Robb, superintendent of motive power, G.T.R., says that the Stratford shops will not be extended at present.

Applications for 20,000 horse-power have been forwarded to the Hydro-Electric Commission by different municipalities.

Port Colborne, Ont., residents have carried a by-law giving concessions to the Great Lakes Portland Cement Company.

Welland, Ont., citizens have passed a by-law granting concessions to the Iroquois Motor Car Manufacturing Company.

John Pillans Carluke, Scotland, says that he intends locating a factory in Canada for the manufacture of bolts and screws.

The St. George Pulp & Paper Co., St. George, N.B., will erect a new saw mill, to replace the one burned down recently.

The Boundary Iron Works Foundry, Grand Forks, has been destroyed by fire. The loss will be in the vicinity of $25,000.

The Canadian Oil Co. are considering the establishment of a branch warehouse and office at either Port Arthur or Fort William.

The Smart-Turner Machine Co. are supplying the Locomotive & Machine Co., Montreal, with three belt-driven vacuum pumps.

The steel plant of the Northern Iron & Steel Co., Collingwood, Ont., has been started up after a period of idleness of about two years.

The James Bay Railway has now been completed as far as Parry Sound, and recently D. D. Mann made a first trip on the road.

The Sage Storm Front Company, of Rosini, Ohio, has started a factory in St. Thomas for the manufacture of buggy coverings.

A new planing mill is to be erected in Stratford for T. M. Ruston to cost $10,000. Building operations have already been commenced.

The Columbus Cobalt Silver Mines are installing a complete steam power plant, consisting of boiler, steam drills, steam pumps, etc.

Waterloo, Ont., has passed a by-law to loan the Interior Hardwood Furnishings Company $10,000 without interest, repayable in ten years.

The Dominion Carriage Co. have commenced work on their new plant at Toronto Junction. They expect to occupy it by the Spring.

The Peterborough Steel Rolling Mills Company is asking the City of Peterborough for a bonus of $6,000 and a right-of-way for a siding.

The Canadian Lock Nut Co., Pearl street, Toronto, have purchased the business and plant of the Canadian Nut Co., Adelaide street west, Toronto.

McLean, Holt & Co., St. John, N.B., are about to put up a manufacturing plant on Courtenay Bay. The new property has a frontage of 700 feet.

The contract for the construction of the new Y.M.C.A. building in Calgary, Alberta, to cost $55,000, has been let. Work on the building has commenced.

The output of steel rails from the rail mill of the Lake Superior Corporation during the past fiscal year has been 62,000 tons in excess of that of last year.

Brandram-Henderson, Limited, have finally decided to locate their lead corroding plant in Montreal, and building operations will be commenced at once.

The Canadian Westinghouse Co., Hamilton, are having a single beam hand-power traveling crane installed by Smart-Turner Machine Co., Hamilton.

The wood working factory of C. W. Gibbs, Winnipeg, has been completely destroyed by fire, including all the machinery. The estimated loss is $10,000.

J. O. Walker and others, of Goderich, ask that town for a loan of $20,000 with which to build a carriage factory. The by-law will be voted on at New Year.

G. E. Bradshaw, of Toronto, representing an American company, is seeking franchises in Galt and other towns to establish central heat transmitting systems.

Moose Jaw has voted $90,000 for the purpose of bringing water from Snowdis Springs to Moose Jaw by gravitation. Snowdis Springs is seven miles from the city.

Prince Albert council will submit a by-law to grant $25,000 to the C.N.R. for the purpose of assisting in the building of a traffic bridge across the Saskatchewan.

Negotiations are in progress for the establishment of a manufacturing plant at Goderich, Ont., by an American firm for the manufacture of baby carriages, go-carts, etc.

The Boundry Iron Works Foundry, Grand Forks, has been completely destroyed by fire together with the machinery installed. The loss will be at least $35,000.

The Town of Qu'Appelle is considering the question of granting a franchise to the Moore Milling Co. for the installation of an electric lighting plant for that town.

Quinlan & Robertson, of Montreal, are the lowest tenderers for the lock and dam to be constructed at St. Andrew's Rapids, near Winnipeg, at a cost of about $500,000.

The Peterborough Boiler & Radiator Co. will locate in Hastings, Ont., on the condition that the village grant them a bonus of $5,000, and exemption from taxation.

The firm of Sinclair & Morrison, Montpelier, Ind., propose to establish a plant in Chatham, Ont., for the manufacture of drillers' tools and supplies to supply the oil district.

The Town of Leamington, Ont., is considering a proposition to lend a Detroit company $30,000 to assist them in manufacturing automobile brass goods and trolley wheels.

The London Fence Co. have let the contract for their fence factory at Portage La Prairie to Carr & Woodman for the brick work and A. McLarty for the carpenter work.

The Waterloo Manufacturing Company have announced their intention of building a storehouse and factory at Portage La Prairie if they can get tax exemption for twelve years.

The corporation of Gravenhurst will develop a waterpower at South Falls, on the Muskoka River, and will transmit the electric power to Gravenhurst, a distance of eight miles.

The Montreal Power Company will before the end of the year lose the street lighting contract of Westmount, a suburb of Montreal, which is building a municipal lighting plant.

The contracts for the bridges on the Transcontinental Railway have been divided, the Dominion Bridge Works Co., and the Locomotive & Machine Co., each building four.

The Ontario Power Co., Niagara Falls, will proceed at once with the completion of the first section of their plant. This will mean the installing of three more turbines and generators.

It is announced that the Ames Holden Co., Limited, will devote a portion of their recently increased capital to the building of a new factory at Montreal, to cost about $200,000.

The Canadian Fairbanks Co., are installing a suction gas plant for supplying power and lighting in the new automobile building of Henry Morgan & Co., on Beaver Hall Hill, Montreal.

Work will be commenced at once on the transformer building of the Canadian General Electric Co., Peterborough, by the contractors, the Dominion Engineering & Construction Co., Montreal.

The contract for the erection of shops and stores buildings for the Intercolonial Railway at Moncton, N.B., has been awarded to E. A. Walberg, Montreal, the contract price being about, $160,000.

The leading citizens of Emerson, Man., are promoting a scheme to develop waterpower on the Rossean River, 22 miles from the town. The scheme has been pronounced feasible by competent engineers.

The increase in duties on agricultural implements imported into Australia is likely to seriously affect the Massey-Harris Company, which concern has for years done an enormous trade with the sister colony.

The Dominion Construction Company, of Montreal, have the contract for the new transformer building for the Canadian General Electric Company at Peterborough. The building and equipment will cost about $250,000.

This year has been the best in the history of the Canadian Pacific Railway. The annual report shows gross earnings of $61,669,758 with working expenses of $38,696,445, leaving net earnings of $22,973,312.

The Town of Cardston, Alta., has purchased from Allis-Chalmers-Bullock, Limited, of Montreal, an electric and water works plant, including generator, switchboard, transformer, lights, and a special compound duplex pump.

The Bain Wagon Co., Woodstock, Ont., are preparing to make a large extension to their plant. The addition will be 120 feet long by 60 feet wide; and 50 additional men will be employed in the Spring of the coming year.

The Detachable Boiler Flue Mfg. Co. have decided to locate their factory at Portage la Prairie. J. M. Crozier is secretary and manager of the company. The factory will be commenced at once and finished, it is expected, in ninety days.

The plant of the Pacific Steel Co., Irondale, B.C., has been sold to Jas. A. Moore for $40,000. Mr. Moore states that the plant will be improved to the extent of $100,000, its capacity being increased to 60 tons of pig iron per day.

The Great Lakes Portland Cement Co., Limited, are to establish a plant in Port Colborne Ont., for the manufacture of Portland cement. Building operations will commence at once but it will be a year before any cement is made.

The Berlin Electrical Mfg. Co., manufacturers of the "Best" dry batteries, have moved from Berlin, Ont., to 474 to 478 King street west, Toronto. In their new quarters the company will have three times the floor space that they had before.

The Maritime Coal, Railway & Power Co. propose to build an thermo-electric power station at their coal mines in Nova Scotia for the generation of electric power from coal, to be transmitted to Amherst, Moncton and intermediate points.

Wm. C. Campbell, Detroit, will equip a factory in Leamington, Ont., for the manufacture of gasoline engines, marine and automobile, and brass and bronze goods. He expects that he will be ready to manufacture by the first of the coming year.

The A. R. Williams Machinery Co., have been appointed Toronto agents for the Dominion Brazing Co., Montreal; and at the A. R. Williams plant on Front street brazing will be carried on according to the process of the Dominion Brazing Co.

The Multi Scale Co., of Guelph, who have recently been incorporated, will engage in the manufacture of what is known as the multi scale. They also purpose making casting of all kinds, and the smaller parts of agricultural and other machinery.

The Cobalt "Silver Queen" has purchased from Allis-Chalmers-Bullock, Limited, Montreal, through the Toronto

office, an electric lighting outfit including a "Bullock" generator driven by a high-speed automatic engine and additional boiler equipment.

A by-law will be submitted to the residents of Hastings, Ont., asking them to give a bonus of $5,000 and tax exemption for ten years to the Peterborough Boiler & Radiator Company, who will establish a plant to cost $75,000, and employ 25 hands.

The action of the Australian Government in placing a fixed duty of £12 on harvesters and a duty of 25 per cent. on other agricultural implements, will effect Canadian trade with Australia not a little, as agricultural implements constitute the big item of trade.

The Canadian Ethinite Co. are making arrangements for the building of a large factory at Niagara Falls, Ont., where they will make "ethinite," the product having similar properties to calcium carbide, which will be used in the making of acetylene gas.

Niagara Frontier Oil & Gas Co., organized under a charter from the State of New York, have been authorized by license from the Ontario Government to carry on the business of oil refiners, etc., in this province. Wm. G. Ryan, of Leamington, will be their attorney.

The Amherst Foundry Co., Amherst, N.S., are making an addition to their foundry building, the size being 75 x 60 feet. This addition to their foundry will enable the company to largely increase their output of enamelware. The cost of the addition will be $4,500.

The Cooper Gasoline Engine Co., Limited, of Winnipeg, Man., are installing a 60 h.p. "Weber" double cylinder vertical gas engine and suction gas producer plant for Messrs. Horn Bros., Markinch, Sask., to operate their new roller mill and elevator at that point.

The Ontario Iron & Steel Co. have let the contract for the construction of its new plant at Welland, Ont., to the Berlin Construction Co., Berlin, Conn. The contract price is $265,000. In its new plant the company will manufacture steel rails, steel plates, bars and angles.

The Standard Gas Engine Co., Marsh Lane, Preston, Eng., are thinking of establishing a plant in Canada for the manufacture of internal combustion engines of all kinds, and are desirous of getting in touch with Canadian engineering firms who would be prepared to establish this plant.

At the annual meeting of the Montreal Reduction & Smelting Co., of Canada, held in the companies offices, St. James street, Montreal, early in the month, the following directors were unanimously elected: J. E. Leonard, M.P., J. H. Brown, O. Lemire, Benjamin Burland, L. J. Carter, O. Robert and P. A. Theriault.

The output of the Cape Breton coal mines this season surpassed all expectations. According to the official statement no less than 67,000 tons of coal have been carried from North Sydney to St. Lawrence ports since the opening of navigation up to Aug. 15, as against 37,500 tons for the corresponding period last year. The company has at work a fleet of twelve vessels and this will be

The Meisel Mfg. Co., of the State of Michigan, are to establish a plant at Port Arthur. This company will manufacture flour mill machinery, saw mill machinery, heavy farm machinery, and other lines. The plant is to be ready for operation by May 1907, and will employ 150 men. The total cost of the plant will be in the vicinity of $100,000.

A United States company who manufacture steel forgings are negotiating with the Town of Welland, Ont., for the location of a plant there. Their agent is Thos. J. Dillon, Titusville, Pa. The company ask a free site, free water, free sewer connections, and a fixed assessment. The Supreme Heating Co. are also negotiating with that town on the same terms.

There are about twenty men at work developing the limestone areas at Irish Cove, N.S. These areas are owned by the Nova Scotia Coal & Steel Co. The limestone is being tested at the furnaces at Sydney Mines, and is said to give fairly good satisfaction. Should it be more entirely so the property will be developed extensively and a large force of men employed.

Among the orders received by the Smart-Turner Machine Co., Hamilton, for their standard duplex pumps, are orders from E. Leonard & Sons, London; Loveland & Stone, Cutler, Ont.; the Lake Simcoe Dredging Co.; E. D. Smith, Beamsville, Ont.; the Parry Sound Lumber Co., Parry Sound, Ont.; Fairgrieves, Limited, Toronto; the Breihaupt Leather Co.; and the Farrar Transportation Co.

The Quebec and Lake St. John Railway has a charter for the construction of a tunnel under the Straits of Belle Isle and for the construction of a line of railway through the Labrador Peninsula to the eastern boundary of the Province of Quebec. They also have a charter for the construction of a railway from the boundary of the Canadian and Newfoundland Labrador to the Straits of Belle Isle.

The Town of Niagara Falls, Ont., is considering the proposition of granting the Canadian Ramapo Iron Works a bonus of $3,000 and a fixed assessment of $1,000 for ten years. This company is a branch of the American company, having plants at Hillburn, N.Y., and Niagara Falls, N.Y. It is capitalized at $300,000. Wallace Nesbitt, K.C., for Hamilton, is president, and F. W. Snow, treasurer and general manager.

A new electric turbine pump has been installed at the McTavish reservoirs, Montreal. It is driven by a 400 h.p. induction motor, built by Allis-Chalmers-Bullock. Some time ago, the city had an electric pump on this spot, but it had to be abolished on account of the unpleasant vibrations made by it. The new installation has been tested by Prof. Herdt and the superintendent of the water department and it has been found to be satisfactory.

It is reported that the Canadian Pacific Company has decided to await the outcome of experiments by the New York Central and New York, New Haven & Hartford Railway Companies before taking steps for the electrification of any part of its system. Both the latter railways are spending enormous sums upon experiments, the former with a direct and the latter with a single-phase alternating current. The line from Montreal to Quebec will in all probability witness the first installation. All the electric power necessary can be obtained from the Shawinigan Falls.

It is announced that a combination of Scotch and English steel tube manufacturers to regulate the home and export business has been formed, with a view to abolishing the present keen competition. The industry has suffered incalculably since the previous agreement between the firms in this line was cancelled 18 months ago. The new agreement is wider in its scope than the old one, taking in all the firms in the United Kingdom except one Clydeside concern. It is expected that an advance in prices will soon be announced, as it is believed the agreement carries permanency with considerably increased by next season. it.

Among recent sales by the electrical department of Allis-Chalmers-Bullock, Limited, Montreal, were a 260 k.w. engine type, alternating current generator, with exciter, switchboard, etc., to the Western General Electric Co., Red Deer, Alta; 300 k.w. engine type alternating current generator, with exciter and other accessories, to the Corporation of Barrie, Ont.; 300 k.w. engine type alternating current generator and 25 k.w. exciter, to the Belleville Portland Cement Co.; 125 k.w. engine type alternating current generator, exciter, etc., to the City of Greenwood water works; 62½ k.w. engine type alternating current generator, switchboard, etc., to C. P. Walker, Winnipeg; 125 k.w. engine type alternating current generator, five 10 h.p., three 15 h.p. and one 20 h.p. induction motor, to P. Burns & Co., Calgary.

The Yukon Consolidated Goldfields Co., Limited, have contracted with the Canadian Westinghouse Co. for the following electrical apparatus to be used in gold dredging in the Yukon Territory: Three 100 h.p., 3-phase, 60 cycles, 400 volts, type F motors; three 15 h.p., 3-phase, 60 cycles, 400 volt, type F motors; three 50 h.p., 850 r.p.m., 3-phase, 60 cycles, 400 volt, constant speed induction motors; three 30 h.p. motors; three 20 h.p., 1,120 r.p.m. motors; three 15 h.p., 850 r.p.m. motors; three 7 1-2 h.p., 1,700 r.p.m. motors; nine 75 k.w. oil insulated, self cooling transformers; two 625 k.w., 3-phase, 60 cycles, 2,200 volt, 415 r.p.m., A. C. generators, and two 17 k.w., type S, exciters for same; one 4-panel switchboard for controlling above; four 250 k.w., oil insulated, oil cooled transformers, and four 200 k.w transformers, same type.

* * *

A Correction.

In last month's issue it was stated that the Economic Power, Light & Heat Supply Co., Toronto, were preparing to build the Pintsch suction gas producer

in Canada and also the National gas engine.

It is not correct that the National gas engine is to be made in Canada; the company will make the producer but will import the engine.

* * *

New Machine Shop and Foundry.

The Madison Williams Foundry Co., have removed from Port Perry to Lindsay, Ont., and in the latter place are building a new plant, consisting of a machine shop, 80 x 130 feet, a foundry, 60 x 55 feet and a pattern shop 40 x 60 feet. The buildings are brick with concrete foundations. The steel for the buildings is being supplied by the Walkerville Malleable iron Works. The machine shop is equipped with a traveling crane The company will manufacture water wheels and heavy machinery of all kinds.

* * *

New Catalogue.

The Chicago Pneumatic Tool Co. announce the fact they will receive from the printers on Sept. 15 their new compressor catalogue, consisting of 118 printed pages, printed in two colors, in which several new types and sizes of compressors are shown including their new Hamilton Corliss machines. Those interested will receive copy upon request.

Owing to the rapidly increasing demand for its products throughout the Southern States, the Chicago Pneumatic Tool Co. have opened an office at 1012 Memphis Trust Building, Memphis, Tenn., in charge of J. Francis Small.

* * *

Foreign Patent.

The following is a list of Canadian patents recently granted to foreigners through the agency of Marion & Marion, Montreal: Jules R. Blum, Paris, machine for removing dust by suction from carpets, etc.; G. C. E. de Bonnechose, Paris, turbine engines; Geo. Hutchinson, Seatoun, New Zealand, milking machines; G. F. Jaubert, Paris, methods for utilizing steam boilers for the propulsion of submarines; Dr. Franz Stolze, Charlottenburg, Germany, hot air engines; Vereulen Claes, Beveren, Belgium, ploughs; G. E. Humphries, Wellington, New Zealand, scaffolding brackets; Summers Brown, London, frame for use with rotary duplicating machines.

* * *

Sherardizing.

Sherardizing is the name given a new process for the prevention of iron and steel corosion. While the results are the same as either hot or cold galvanizing, the method is said to be cheaper, more convenient, and gives a better coating. An interesting feature is that iron and steel can be coated with an even deposit of zinc at a temperature several hundred degrees below zinc's melting point. The first step is to free the iron from scale and oxide by any familiar method. It is then placed in a closed iron receptacle charged with zinc dust, which is heated to a temperature of from 500 to 600 degrees, turned for a few hours, and allowed to cool. On removing the iron it is found coated with a thin homogeneous covering of zinc, the thickness depending on the temperature and the length of time. The temperature required is about 200 degrees below the melting point of zinc, this low temperature rendering the process cheap as compared with the dipping process. It has the additional advantage of not deteriorating the iron or steel of small sections to the same extent as hot galvanizing; and there is no loss of zinc dust. The process is not limited to the coating of iron with zinc, since it has already been successfully applied to coating iron with copper, aluminum, and antimony. It has also been used to coat other metals, such as aluminium and copper with zinc. Copper and its alloys, treated in this way, are case hardened on the surface, and can be made so hard as to turn the edge of tool steel.

* * *

Dominion Pressed Steel Co.

The Dominion Pressed Steel Company, of Port Elgin, Ont., have their shovel plant about ready for work. The factory is built of concrete, 50 by 160 feet. The main building is three storeys high with a felt and gravel roof, and concrete floor on the lower flat. There will be seven furnaces at the commencement, run with oil fuel. The oil is atomized by an air blast furnished by a Sturtevant fan. There will be four power hammers, two of 600 pounds, one of 400 and one of 100 pounds. There will also be eight power presses. The strop rolls is a ponderous machine put in at great expense. A separate building will contain machinery for making their own handles. The workshop will have two power lathes, planer, drill, grinder and forge. A 100 h.-p. Goldie-McCulloch engine with two boilers will supply the power.

* * *

The A. L. A. M. Standard Screw.

The Association of Licensed Automobile Manufacturers, New York, are distributing all over the United States and Canada copies of the specifications for the new standard screw for automobile manufacturers, which new standard has been evolved from the old U. S. standard screw. There is nothing revolutionary in the new standard which even conforms to the general practice of many machine tool and automobile builders. The reason for adopting this standard is that a finer thread than that of the U. S. standard has been found necessary in many classes of work and the new thread is designed to meet that need.

Considerable study was put on the dimensions of the nuts and heads; careful destructive tests were made before the standard was adopted, to make it absolutely certain that the nuts and heads were large enough and that the threads would not strip. Tests were made with ordinary material and with the material it is proposed to use for automobile work. The results were the same in both cases; that is, the screw broke at the base of the thread inside the nut, which was to be expected.

The association expect that the new standard will gradually come into use for the purpose for which it was designed.

* * *

Largest Generator.

The largest generator ever made in this country has just been made ready for shipment to British Columbia from the works of the Canadian Westinghouse Co., of Hamilton. The purchaser is the British Columbia Electric Railway Co., of Vancouver. The generator is 2,000 horsepower, 3 phased, 7,200 alternations, 200 revolutions per minute, engine type for direct connection with the water wheel. The order also includes one rotary converter of 1,350 horsepower, 550 volts, 3 phase, 7,200 alternations, 400 revolutions per minute, and eight air blast transformers each of 733 horsepower, 2,200 volts to 24,200 volts, 7,200 alternations. The necessary switchboard and regulating and controlling devices were also manufactured in this plant.

* * *

Sales Offices in Toronto.

An evidence of the growth of the London Machine Tool Co. was the recent construction of their new plant at Hamilton, with greatly increased facilities for the manufacture of their machine tools; and now a further evidence is the opening up of sales offices at room 1206 Traders' Bank Building, Toronto. From these sales offices will be sold machinery of all kinds, as well as the machine tools from their own manufacturing plant. Several exclusive agencies in the lines of wood-working and iron-working machinery have already been secured, while at present negotiations are being conducted with a view to others. Among these agencies are the Kempsmith Milling Machine Co., Milwaukee, and the Sibley Machine Tool Co., South Bend, Ind.

* * *

A New Manufacturers' Agency Firm.

A new firm of manufacturers' agents has been organized in Montreal, under the name of Baxter, Patterson & Co., to handle all kinds of iron and wood-working machinery, engines, fire appliances and engineering and mill supplies. The company have been appointed sole Canadian agents for several large firms in England, Scotland, and on the continent, among them being: Geo. Angus & Co., manufacturers of leather and Balata belting, Newcastle-on-Tyne, England; Walter McFarlane & Co., manufacturers of ornamental castings and soil pipe, Glasgow; Wm. Bain & Co., manufacturers of fencing; and the Cundall Gas Engine Co., England. Special arrangements have also been made with the Nicholson File Co., Port Hope, Ont., whereby the firm will manufacture their highest grade file.

J. R. Baxter is Scotch by birth, but has received an English education in theoretical and practical engineering; and for the past four years he has been in Canada making a special study of conditions here and is well known in business and social life in Montreal. Mr. Baxter will have charge of the practical and selling end of the business.

Wm. Patterson, the other active member of the firm, is also Scotch by birth. He has been connected with the practical side of engineering for the last ten years in Glasgow and Montreal, during which time he has acquired a thorough knowledge of office management. Mr. Patterson will assume the management of the financial end of the business.

The premises of the new firm are at 102 St. Antoine street, Montreal. They have a frontage of 65 feet on that street and 25 feet on Cathedral street. They will have three floors and a basement at their disposal.

* * *

The Steel Output Doubled.

The iron and steel bounty payments paid by the Dominion Government for the financial year up to July 1 amount to $2,004,339, as compared with $1,540,-203 in 1905. The payments indicate a very large increase in the output of the Canadian iron and steel industries.

Bounty amounting to $687,631 was paid on a total output of 581,858 tons og pig iron; of this, 86,523 tons was made from Canadian ore. The bounty on this was at the rate of $1.65, and totalled $142,263; 495,335 tons were made from foreign ore. The bounty on this was at the rate of $1.10, and totalled $544,868.

Last year's output of pig iron was 386,719 tons, of which 327,267 tons were made from foreign and 59,452 from Canadian ore. The rates of bounty were higher, however, last year, viz., $1.50 on foreign and $2.25 on Canadian ore, so the total amount paid as pig iron bounty, was $624,167, of which $490,401 was on foreign and $133,766 on Canadian ore.

Of steel ingots, 569,237 tons were made in the Canadian mills during the past year, as compared with 272,916 tons in 1905 The bounty in 1906 at the rate of $1.65 per ton, was $941,000. In 1905, at the rate of $2.25 per ton, it was $614,433. Of puddled bars, 3,560 tons were made in 1906, as compared with 3,509 tons, the year before. The bounty, at $1.65 per ton, this year, was $5,875. The payments last year at $2.25 per ton were $7,895.

The Government paid a bounty in 1906 of $369,832 on 72,875 tons of rolled angles, wire, rods, plates, etc. In 1905 the payments were $293,208, and the output 59,842 tons.

These iron and steel bounties expire next year unless they are renewed by parliament The bounty rate on pig iron from Canadian ore and on puddled bars and steel ingots this year is $1.05 per ton The rate on pig made from foreign ore is 70 cents a ton.

The lead bounty in 1906 totalled $90,-197, as compared with $330,645 the year before, the rate of bounty being much lower on account of the higher price of lead in the world's markets.

The petroleum bounty, at the rate of 1 1-2 cents per gallon, showed payments amounting to $291,157, as compared with $350,047 in 1905.

There was also paid a bounty amounting to $15,079 in manila used in the manufacture of binder twine, as compared with $13,789. In 1906 the bounty was allowed on 4,423,300 lbs. of manila used in the manufacture of 8,617,457 lbs. of binder twine.

Companies Incorporated

P. J. Powers Co., Limited, Ottawa; capital, $45,000; purpose, to carry on a foundry and machine shop. Directors are: P. J. Powers, M. Lannon, M. Vian and L. Dalpe, all of Ottawa.

The Belmont Mfg. Co., Limited., Montreal; capital, $45,000; purpose, to manufacture and deal in waterproof garments. Directors are: H. Fitzgerald, Geo. Whitfield, A. E. Emblem, all of Montreal.

Canada Quarry & Transportation Co., Limited, Montreal; capital, $20,000; purpose, to operate quarries, sand pits, dredges, etc. Directors are: T. Gauthier, S. R. Gauthier, Montreal, and L. Leger, Lachine.

Hurley Machine Co., Limited, Toronto; capital, $40,000; purpose, to manufacture and deal in all kinds machinery. Directors are. W. Gow, J. S. Lovell, E. W. McNeill, W. F. Ralph, and R. Gowans, all of Toronto.

International Marine Signal Co., Limited, Ottawa; capital, $1,200,000; purpose, to manufacture all kinds of aids to navigation. Directors are: T. J. Willson, Ottawa; H. A. Little, Woodstock; A. M. Scott, Ottawa.

North American Wrecking Co., Limited, Montreal; capital, $60,000; purpose, to carry on the business of wrecking and the performance of salvage services. Directors are: D. Armour, E. F. Surveyor, E. M. McDougall, all of Montreal.

The St. Lawrence & Great Lakes Dredging & Wrecking Co., Limited, Montreal; capital, $350,000; purpose, to manufacture and operate dredging plants. Directors are: J. E. Russell, W. J. McWhinney, E. P. Brown, all of Toronto.

The Quebec, Ontario & Cobalt Silver Mining Co., Limited, Montreal; capital, $1,000,000; purpose, to carry on a general mining business. Directors are: L. J. Labrosse, St. Eugene, Ont.; F. X. Dupuis, Valleyfield, Que., and J. A. Tanguay, Montreal.

The Robert White Co., Limited, Montreal; capital, $250,000 purpose, to manufacture boots and shoes, and to manufacture and bottle mineral waters, etc. Directors are: J. T. Marichal, J. P. Landry, H. E. Moles, C. A. Richardson, all of Montreal.

The Canadian Shuttle Co., Limited, Montreal; capital, $125,000; purpose, to manufacture and deal in shuttles and other mill supplies. Directors are: C. N. Blakeley, H. D. Metcalf, O. B. D'Aoust, Chas. Blakeley, W. S. Hutchinson, all of Montreal.

The Canadian Coal & Navigation Co., Limited, Tillsonburg; capital, $500,000; purpose, to mine, manufacture and deal in coal, coke, etc. Directors are: E. C. Jackson, G. W. Fillson, V. A. Sinclair, E. V. N. Fillson, S. H. Betts and C. H. Denton, all of Tillsonburg.

Iroquois Motor Car Co., Limited, Welland; capital, $96,000; purpose, to manufacture and deal in all kinds of automobiles, motor boats, etc. Directors are: J. F. Mills, Buffalo; D'Arey Scott, Ottawa; A. Griffiths, G. H. Sutherland, J. H. Crow, Welland, Ont.

The Porto Rico Railways Co., Limited, Halifax, N.S.; capital, $3,000,000; purpose, to construct and operate railways in the island of Porto Rico and elsewhere. Directors are: W. N. Tilley, B. H. Parmenter, A. J. Thomson, G. F. Ronald, L. Huffman, E. W. H. Holme, all of Toronto.

The Ontario Oil & Refining Company have been incorporated under Ontario charter with a share capital of $100,000 for the purpose of operating oil wells, gas wells, etc. The provisional directors are C. T. Hobart, G. W. Harrison, T. K. Holmes, J. M. Pike, and James Simon, with head office at Chatham.

The Canadian Steel Construction Company have been incorporated under Ontario charter with a share capital of $50,000 for the purpose of manufacturing and dealing in steel tanks, machinery, engines, etc. The provisional directors are W. J. Lethbridge, D. S. Storey and F. W. Grant, with head offices at Midland.

Benjamin Moore & Co. have been incorporated under Ontario charter with a share capital of $50,000 for the purpose of carrying on the business of paint manufacturers. The provisional directors are H. B. Johnson, J. H. Whitehead, E. W. Wright, C. W. Thompson and Eva Marie Gardiner, with head office at Toronto.

Messrs. N. J. Kerr, A. W. Fraser, R. C. Tate, John Moffat, J. A. Garvin, and W. H. Ostrom, have been incorporated as the Ottawa Sales Co., to deal in inventions, assist people in securing patents and carry on the business of manufacturing or selling any article covered by letters patent. The capital stock is placed at $40,000.

The Peterborough Steel Rolling Mills Co. have been incorporated under Ontario charter with a share capital of $200,000, for the purpose of manufacturing iron and steel and their different products. The provisional directors are Wm. Ferguson, Wm. Rudkins, R. J. Munro, A. Dunn, R. H. Fortye, Daniel O'Connell and A. Elliott, with head office at Peterborough.

P. J. Powers Co. have been incorporated under Dominion charter with a capital stock of $45,000 for the purpose of carrying on a general foundry business and take over the business of Powers & Co. The provisional directors are P. J. Powers, M. Lannon, T. McBrearty, Maxime Vian and Lorenzo Dolpe, with head office at Ottawa.

PERSONAL MENTION.

W. F. Hampton, Canadian representative of Edgar Allen & Son, steel manufacturers, will sail for England on the Empress of Ireland on her next trip.

* * *

Mr. J. De Clercy, M.E., has been in Toronto for some time superintending the installation of a 75 h.p. Dominion gas producer plant in the Chalmers Milling Co.'s mill at East Toronto.

* * *

Mr. P. W. Sothmann, a graduate of the Institute of Technology at Charlottenberg, and a native of Denmark, has been appointed chief engineer of the Hydro-Electric Power Commission. Mr. Sothmann has had considerable experience in various water power and steam power developments in Germany, Russia and South Africa.

* * *

Chas. J. Crowley, C.E., at one time resident engineer of the Grand Trunk Railway, Toronto, has just had the satisfaction of seeing the east bound and west bound shields in one of the 23-foot twin tubes which the Pennsylvania Railway have been driving under the Hudson River, to connect New York and New Jersey, meet. of which work he has been in charge for the last two and a half years.

* * *

Mr. Charles H. Mitchell, C.E., has recently returned from his eight months tour in Europe, where amongst other matters he has been studying the water power and electric installations in Italy, Switzerland and Austria. For four years previously Mr. Mitchell, who is well known in Canadian engineering circles, was chief assistant engineer of the Ontario Power Company at Niagara Falls. Mr. Mitchell will resume his former consulting practice, making a specialty in hydro-electric work and railways, and while still retaining an office at Niagara Falls, Canada, will establish an office also in the Traders Bank building, Toronto, after October 1.

* * *

On his return from his recent western trip, H. J. Fuller, Montreal, president of the Canadian Fairbanks Co., announced that John E. Botterell had been appointed manager of the company's Winnipeg branch, succeeding F. Ross Newman. Mr. Newman has assumed the management of Caverhill, Learmont & Co.'s western business, with headquarters at Winnipeg. Mr. Botterell has been connected with the firm for some time, and for the past few years has been manager of their Vancouver branch. While in Winnipeg Mr. Fuller gave a private dinner at the Royal Alexander, to Messrs. Newman and Botterell, a number of the staff being present.

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The above does not apply to notices under the head of "Machinery Wanted." These notices are inserted free for subscribers.

TO ELECTRICAL ENGINEERS.

ONE of the oldest European electrical manufacturing companies, having five works in different countries, and whose name, exceptional reputation and experience are known throughout the engineering circles of the world, is desirous of appointing representatives in British North America. It is considered that responsible agents with sound technical knowledge and used to big undertakings can undoubtedly handle its leading lines with success, notwithstanding the existing competition from Canadian firms. Applications emanating from well-established engineering firms, having branch offices in the different cities of Canada, will alone be considered. Replies to be addressed to Box 49, CANADIAN MACHINERY, Toronto. [9]

TECHNICAL BOOKS.

BOOKS for Engineers, Mechanics, Draughtsmen, etc. Send address for our latest catalogue of practical, up-to-date works, forwarded post free to any address. Technical Publishing Co., Ltd., 287 Deansgate, Manchester, England. [9]

HAVE you seen our Mechanical and Electrical Pocket Books? They are simply crammed with information invaluable to engineers and others. Many thousands circulated in the States. Price 1s. 2d. and 1s. 8d each post free. Technical Publishing Co., Ltd., 287 Deansgate, Manchester, England. [10]

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FACTORY site or subdividing property; 26 acres or 200 lots; in Industrial St. Catharines; clean, level, dry, square block; inside city; water and rail facilities; electric line passes property; cheap electric power and natural gas; exemptions; best labor conditions; bargain; W. B. Clark, trustee, Port Dalhousie, Ontario. [8]

SITUATIONS VACANT

WANTED — Capable young man with fair knowledge of mechanics, and good appearance as city traveller in Winnipeg. Good position for right man. Box 57 CANADIAN MACHINERY, 511 Union Bank Building, Winnipeg.

WANTED—By new firm, traveler for engine rs' supplies. Good salary to experienced man with good connection. Full particulars from Baxter, Paterson & Co., care of CANADIAN MACHINERY, Montreal. [10]

HELP WANTED

LATHE, BENCH AND PLANER HANDS WANTED AT ONCE.

Steady Work and Good Wages to Competent Men.

Address Stating Age, Experience, Married or Single and Wages Expected

B. F. BARNES COMPANY
ROCKFORD, ILL.

FOR SALE

SASH and door factory, running every day; situated on the O. and N.Y. Railroad, twenty miles from Ottawa. For further particulars enquire W. C. Millar, Russell, Ont. (9)

"LITTLE GIANT" turbine water wheels, machine-cut wood and iron tooth gearing; power transmission machinery orders executed with despatch; get catalogue and prices. J. C. Wilson & Co., Glenora, Ont.

PEERLESS self-oiling engine — 15" x 11"—150 h.p. at 250 revolutions per minute; automatic governor; balanced valve; pulley 66"x 14" c.f.; extended subbase for direct connection to 100-k.w. generator, 5" steam pipe, 6" exhaust; run only for a short time; in first-class condition. Belleville Portland Cement Co., Ltd. Belleville, Ont.

CONCRETE MIXERS — Automatic portable mixers; measures cement water and material accurately; satisfaction guaranteed; also gas and gasoline engines; two to twenty-five horse power; write for catalogues and further information. Goold, Shapley & Muir Co., Limited, Brantford, Canada.

FOR SALE—Planing and sash factory; good condition; also good frame cottage, stable and 4 5 acre of land. For particulars apply Box 298, Ripley, Ont.; price $4 000; easy terms.

WHEN you want steel castings, propeller wheels water wheels or gears, write The Wm. Kennedy & Sons, Limited, Owen Sound.

WE wish to call the attention of band and circular saw mill owners to our perfect steam feed valves: write for particulars. Midland Engine Works Co.

SAWMILL FOR SALE — Ten thousand per day; town of Powassan. D. Clark, Powassan.

P. PAYETTE & CO., Penetang, manufacturers lath and picket machinery.

MACHINERY WANTED.

FOR the corporation of the village of Dundalk; second hand or new double cylinder force pump, suitable for 1½ or 2 inch hose. Apply to John Sinclair, Reeve.

FIVE horse power direct current 500 volt motor. Roman Stone, Ltd, Marlborough avenue, Toronto.

SECOND-HAND Leonard ball automatic engines; of any size from 10 h.p. up to 100 h.p.; state number age and condition. E. Leonard & Sons, London Ont.

IRON WORKS FOR SALE

Including Foundry, Machine and Boiler Shops, as a going concern. Located in Western Canada, doing good business and up-to-date plant. Apply to

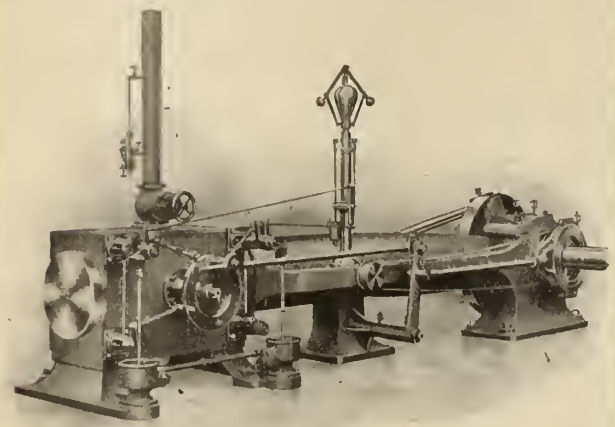
BOX 302 CANADIAN MACHINERY, TORONTO

Corliss Engines

50 to 600 Horse Power

Boilers

Horizontal
Vertical
Locomotive



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Canada Machinery Agency

W. H. NOLAN, Prop.

298 St. James Street, MONTREAL

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The **Smart-Turner Machine Co.** Limited

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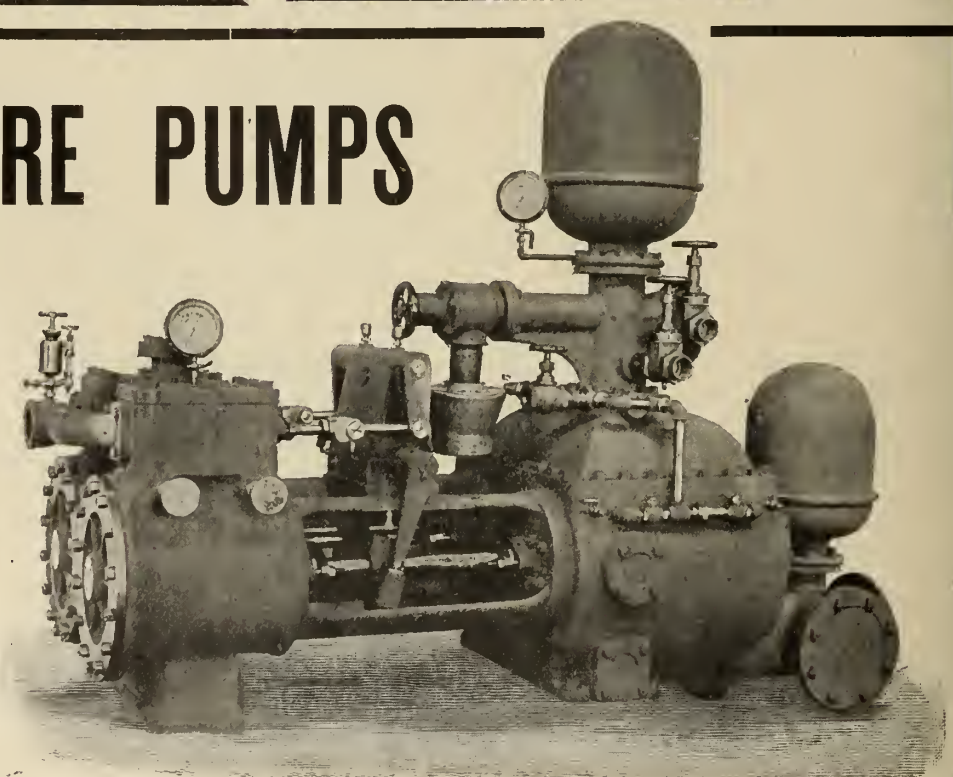
STEAM FIRE PUMPS

Power Pumps
Steam Pumps
Turbine Pumps
for all duties



Canada Foundry Company, Limited

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District Offices: MONTREAL, HALIFAX, OTTAWA, WINNIPEG, VANCOUVER, ROSSLAND.

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Air Brakes.

Canada Foundry Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Air Receivers.

Allis-Chalmers-Bullock Ltd., Montreal.
Canada Foundry Co., Limited, Toronto.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Jenckes Machine Co., Sherbrooke, Que.

Arbor Presses.

Niles-Bement-Pond Co., New York.

Augers.

Chicago Pneumatic Tool Co., Chicago.
Rice Lewis & Son, Toronto.

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Globe Machine & Stamping Co., Cleveland, Ohio.

Axle Cutters.

Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Hespeler, Ont.

Axle Setters and Straighteners.

Canadian Buffalo Forge Co., Montreal.
Dominion Henderson Bearings, Limited, Toronto.
A. B. Jardine & Co., Hespeler, Ont.

Babbit Metal.

Canada Metal Co., Toronto.
Canada Machinery Agency, Montreal.
Rice Lewis & Son, Toronto.
Miller Bros. & Toms, Montreal, Que.

Bakers' Machinery.

Pendrith Machinery Co., Toronto.

Barrels, Tumbling.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.
Globe Machine & Stamping Co., Cleveland, Ohio.
R. McDougall Co., Galt, Ont.
Miller Bros. & Toms, Montreal, Que.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Bars, Boring.

Dominion Henderson Bearings, Limited, Toronto.
Miller Bros. & Toms, Montreal, Que.
Niles-Bement-Pond Co., New York.
H. B. Underwood & Co., Philadelphia.

Batteries, Dry.

Berlin Electrical Mfg Co., Berlin, Ont

Batteries, Flashlight.

Berlin Electrical Mfg Co., Berlin, Ont.

Batteries, Novelty.

Berlin Electrical Mfg. Co., Berlin, Ont.

Batteries, Storage.

Canadian General Electric Co., Limited, Toronto.
Chicago Pneumatic Tool Co., Chicago.
Rice Lewis & Son, Toronto
John Millen & Son, Ltd., Montreal, Que.

Bearings, Roller.

Dominion Henderson Bearings, Limited. Toronto.

Bell Ringers.

Chicago Pneumatic Tool Co., Chicago.

Belting, Chain.

Canada Machinery Agency, Montreal.
The Dodge Mfg. Co., Toronto.
Link-Belt Eng. Co., Philadelphia
Miller Bros. & Toms, Montreal, Que.
Waterous Engine Works Co., Brantford.

Belting, Cotton.

Canada Machinery Agency, Montreal,
Dominion Belting Co., Hamilton.
Rice Lewis & Son, Toronto.

Belting, Leather.

Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
The Dodge Mfg. Co., Toronto.
Rice Lewis & Son, Toronto.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.
Williams & Wilson, Montreal.

Belting, Rubber.

Canada Machinery Agency, Montreal.
Dodge Mfg. Co., Toronto.

Belting Supplies.

The Dodge Mfg. Co., Toronto.
Rice Lewis & Son, Toronto.
H. W. Petrie, Toronto.
Sadler & Haworth, Montreal.

Bending Machinery.

John Bertram & Sons Co., Dundas, Ont.
Chicago Pneumatic Tool Co., Chicago.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Benders, Tire.

Boynton & Plummer, Worcester, Mass.
Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.

Blast Furnace Brick.

Hamilton Facing Mill Co., Hamilton.

Blowers, Turbine Driven.

Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
Kerr Turbine Co., Wellsville, N.Y.

Blue Printing.

The Electric Blue Print Co., Montreal.

Boilers.

Canada Foundry Co., Limited, Toronto.
Canada Machinery Agency, Montreal.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Manitoba Iron Works, Winnipeg.
John McDougall Calenonian Iron Works, Montreal.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Boiler Compounds.

Canada Chemical Mfg. Co., London, Ont.
Economical Mfg. & Supply Co., Toronto.
Hamilton Facing Mill Co., Hamilton.

Bolt Cutters.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Bolt and Nut Machinery.

John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co. New York.

Books, Mechanical.

Technical Pub. Co., Manchester.
The MacLean Pub. Co., Ltd., Toronto.
Spon & Chamberlain, New York

Boring and Drilling Machines.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Boring Machine, Upright.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
London Mach Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Boring Machine, Wood.

Chicago Pneumatic Tool Co., Chicago.
London Mach. Tool Co., Hamilton, Ont.

Boring and Turning Mills.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Box Puller.

A. B. Jardine & Co., Hespeler, Ont.

Brakes, Automobile,

Globe Machine & Stamping Co., Cleveland, Ohio.

Brass-Washing Machinery.

Warner & Swasey Co., Cleveland O.

Brushes, Foundry and Core.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Bulldozers.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York.

Calipers.

Brown & Sharpe, Providence, R.I.
Rice Lewis & Son, Toronto.
John Millen & Son, Ltd, Montreal Que.
L. S. Starrett & Co., Athol, Mass.
Williams & Wilson, Montreal.

Can Making Machinery

Canada Machinery Agency, Montreal.
Miller Bros. & Toms, Montreal, Que.

Cars, Foundry.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Castings, Grey Iron.

Allis-Chalmers-Bullock Ltd., Montreal.
Dodge Mfg. Co., Toronto.
Dominion Rock Drill Co., Napanee, Ont.
Jenckes Machine Co., Sherbrooke, Ont.
Laurie Engine & Machine Co., Montreal.
R. McDougall Co., Galt, Ont
Smart-Turner Machine Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.
Western Machine Co., Stouffville.

Castings, Brass.

Chadwick Bros., Hamilton.
Jenckes Machine Co., Sherbrooke, Que.
R. McDougall Co., Galt, Ont.

Castings, Semi-Steel.

Western Machine Co., Stouffville.

Cement Machinery.

Allis-Chalmers-Bullock, Limited, Montreal
St. Lawrence Supply Co., Montreal.

Centreing Machines.

John Bertram & Sons Co., Dundas, Ont.
Dominion Henderson Bearings, Limited, Toronto.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Centres, Milling Machine.

The Stevens Co., Galt, Ont.

Centres, Planer.

American Tool Works Co., Cincinnati.
The Stevens Co., Galt, Ont.

Centres, Shaper.

The Stevens Co., Galt, Ont.

Centrifugal Pumps.

Canadian Buffalo Forge Co., Montreal.
R. McDougall Co., Galt, Ont.
D'Olier Engineering Co., New York.
Pratt & Whitney Co., Hartford, Conn.

Centrifugal Pumps—Turbine Driven.

Canadian Buffalo Forge Co., Montreal.
Kerr Turbine Co., Wellsville, N.Y.

Charcoal.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Chemicals.

Canada Chemical Co., London.
Economical Mfg. & Supply Co., Toronto.

Chucks, Ring Grinding.

A. B. Jardine & Co., Hespeler, Ont.
Chicago Pneumatic Tool Co., Chicago.
W. B. McLean & Co., Montreal, Que.

Chucks, Drill and Lathe.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
Ker & Goodwin, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
John Milleu & Son, Ltd. Montreal, Que
W. B. McLean & Co., Montreal, Que.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Rice Lewis & Son, Toronto.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg. Co, St. Catharines.

Chucks, Planer.

American Tool Works Co., Cincinnati.
Canada Machinery Agency, Montreal.
W. B. McLean & Co., Montreal.
Niles-Bement-Pond Co., New York.

Chucking Machines.

American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Circuit Breakers.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.

Clippers, Bolt.

A. B. Jardine & Co., Hespeler, Ont.

Cloth and Wool Dryers.

Canadian Buffalo Forge Co., Montreal.
B. Greening Wire Co., Hamilton, Ont.
McEachren Heating and Ventilating Co., Galt, Ont.

Compressors, Air.

Allis-Chalmers-Bullock, Limited, Montrea
Canada Foundry Co., Limited, Toronto.
Canada Machinery Agency, Montreal.
Canadian Rand Drill Co,, Montreal.
Canadian Westinghouse Co., Hamilton.
Chicago Pneumatic Tool Co., Chicago.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.

Concentrating Plant.

Allis-Chalmers-Bullock, Limited, Montrea

Concrete Mixers.

Link-Belt Co., Philadelphia.

Condensers.

Canada Foundry Co., Limited, Toronto.
Canada Machinery Agency, Montreal.
Smart-Turner-Machine Co., Hamilton.
Waterous Engine Co., Brantford.

Confectioners' Machinery.

Pendrith Machinery Co., Toronto.

Consulting Engineers.

Charles Brandeis, Montreal.
Canadian White Co., Montreal.
Dominion Henderson Bearings, Limited, Toronto.
Jules De Clercy, Montreal.
John S. Fielding, Toronto.
Miller Bros. & Tom, Montreal.
Roderick J. Parke, Toronto.
Plews & Trimingham, Mootreal.
T. Pringle & Son, Montreal.
James C. Royce, Toronto.

Contractors.

Canadian White Co., Montreal.
D'Olier Engineering Co., New York.
Expanded Metal and Fireproofing Co., Toronto.
Laurie Engine & Machine Co., Montreal
Miller Bros. & Toms, Montreal.
The Smart-Turner Mach. Co., Hamilton

Controllers and Starters Electric Motor.

Allis-Chalmers-Bullock, Ltd. Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
T & H Electric Co., Hamilton.

Conveyor Machinery.

The Dodge Mfg. Co., Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Link-Belt Co., Philadelphia.

Miller Bros. & Toms, Montreal.
Smart-Turner Machine Co., Hamilton.
Laurie Engine & Machine Co., Montreal.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Coping Machines.

John Bertram & Sons Co., Dundas, Ont.
London Mach Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Core Compounds.

Dominion Foundry Supply Co , Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Core Ovens.

Hamilton Facing Mill Co., Hamilton and Montreal.

Core Oven Bricks.

Hamilton Facing Mill Co., Hamilton and Montreal.

Cotton Belting.

Dominion Belting Co., Hamilton and Montreal.

Cranes, Electric and Hand Power.

Canada Foundry Co., Limited, Toronto
Dominion Foundry Supply Co., Montrea and Toronto.
Hamilton Facing Mill Co , Hamilton and Montreal.
Link-Belt Co., Philadelphia.
Miller Bros & Toms, Montreal.
Niles-Bement-Pond Co., New York.
Smart-Turner-Machine Co., Hamilton.

Crushers, Rock or Ore.

Allis-Chalmers-Bullock. Ltd., Montreal.

Contractors' Plant.

Allis-Chalmers-Bullock, Ltd , Montreal.

Crank Pin Turning Machine

London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co , New York.

Crucibles.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Crucible Caps

Hamilton Facing Mill Co., Hamilton.

Crushers, Rock or Ore.

Allis-Chalmers-Bullock Co., Montreal.

Cupolas.

Dominion Foundry Supply Co., Montreal and Toronto
Hamilton Facing Mill Co,, Hamilton and Montreal.

Cupola Blowers.

Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co , Montreal
Hamilton Facing Mill Co., Hamilton and Montreal.
McEachren Heating and Ventilating Co. Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F Sturtevant Co., Hyde Park, Mass.

Cutters, Coal.

Allis-Chalmers-Bullock, Ltd , Montreal.

Cut Meters.

The Canadian Fairbanks Co., Montreal

Cutters, Flue

Chicago Pneumatic Tool Co., Chicago.

Cutters, Milling.

Becker, Brainard Milling Machine Co. Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
Pratt & Whitney Co . Hartford, Conn.
Standard Tool Co., Cleveland.

Cutting-off Machines.

John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
A. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.

Cutting-off Tools.

Armstrong Bros. Tool Co., Chicago.
London Mach. Tool Co., Hamilton, Ont.
H. W. Petrie, Toronto.
Pratt & Whitney, Hartford, Conn.
Rice Lewis & Son, Toronto.
L. S. Starrett Co., Athol, Mass.

Cylinder Boring Bars.

H. B. Underwood & Co , Philadelphia

Dies

Globe Machine & Stamping Co., Cleveland, Ohio.

Die Stocks

Hart Manufacturing Co., Cleveland, Ohio

Dies, Opening.

W. H. Banfield & Sons, Toronto.
Globe Machine & Stamping Co., Cleveland Ohio.
R. McDougall Co., Galt, Ont.
Pratt & Whitney Co., Hartford, Conn.

Dies, Sheet Metal.

W. H. Banfield & Sons, Toronto.
Globe Machine & Stamping Co., Cleveland, Ohio.

Die Sinkers

Globe Machine & Stamping Co., Cleveland Ohio.

Dies, Threading,

John Millen & Son, Ltd , Montreal.

Draft, Mechanical.

W. H. Banfield & Sons, Toronto.
Butterfield & Co., Rock Island. Que.
A. B. Jardine & Co., Hespeler.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.

Dowel Pins.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Drawing Instruments.

W. B. McLean & Co., Montreal
Rice Lewis & Son, Toronto.

Drawing Supplies.

The Electric Blue Print Co., Montreal

Drawn Steel, Cold.

Miller Bros. & Toms, Montreal.
Union Drawn Steel Co., Hamilton.

Dredges, Gold, Dipper and Hydraulic.

Allis-Chalmers-Bullock Co., Montreal.

Drilling Machines, Arch Bar.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co , Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Boiler.

American Tool Works Co., Cincinnati.
Canadian Buffalo Forge Co., Montreal.
John Bertram & Sons Co., Dundas, Ont.
Bickford Drill and Tool Co., Cincinnati.
Boynton & Plummer, Worcester, Mass.
The Canadian Fairbanks Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines Connecting Rod.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Locomotive Frame.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co , Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Multiple Spindle.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Bickford Drill & Tool Co., Cincinnati.
Canada Machine y Agency Mon real.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Pneumatic

Canada Machinery Agency, Montreal.

Drilling Machines, Portable

Canadian Buffalo Forge Co , Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
H. B. Underwood & Co., Philadelphia

Drilling Machines, Radial.

American Tool Works Co , Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Bickford Tool & Drill Co., Cincinnati.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Suspension.

John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co. New York

Drilling Machines, Turret.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Upright.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Boynton & Plummer, Worcester, Mass.
Canadian Buffalo Forge Co., Montreal.
The Canadian Fairbanks Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
W. H. Petrie, Toronto.
Williams & Wilson Montreal.

Drills, Bench.

B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Canadian Buffalo Forge Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.

Drills, Blacksmith.

Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co , Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
New Process Twist Drill Co., Taunton, Mass.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg., Co., St. Catharines.

Drills, Centre.

Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
L. S. Starrett Co., Athol, Mass.

Drills, Electric

B. F. Barnes Co,, Rockford, Ill.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drills, Gang.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Pratt & Whitney Co.. Hartford, Conn.

Drills, High Speed.

Wm. Abbott, Montreal.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
New Process Twist Drill Co , Taunton, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Whitman & Barnes Mfg. Co., St. Catharines.

Drills, Hand.

Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.

Drills, Horizontal.

B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drills, Jewelers.

Pendrith Machinery Co., Toronto.

Drills, Pneumatic.

Canada Machinery Agency, Montreal.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drills, Radial.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drills, Ratchet.

Armstrong Bros. Tool Co , Chicago.
A. B. Jardine & Co., Hespeler,
New Process Twist Drill Co., Taunton, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg., Co., St. Catharines.

Drills, Rock.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Drills, Sensitive.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Canada Machinery Agency Montreal.
Niles-Bement-Pond Co., New York

Drills, Shop View.

John Bertram & Sons Co., Dundas, Ont.

Drills, Twist.

Chicago Pneumatic Tool Co., Chicago.
Alex. Gibb, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
John Millen & Son, Ltd., Montreal.
Morse Twist Drill and Machine Co., New Bedford, Mass.
New Process Twist Drill Co., Taunton, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

Drying Apparatus of all Kinds.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Dump Cars.

Canada Foundry Co.. Limited, Toronto.
Dominion Henderson Bearings, Limited, Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.
Jenckes Machine Co., Sherbrooke, Que
Link-Belt Eng. Co., Philadelphia.
Miller Bros & Toms, Montreal.
Waterous Engine Co., Brantford.

Dust Separators.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.

Dynamos.

Allis-Chalmers-Bullock, Limited Montreal
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
D'Olier Engineering Co., New York.
John Millen & Son, Ltd., Montreal.
Packard Electric Co., St. Catharines.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Dynamos—Turbine Driven.

Kerr-Turbine Co., Wellsville, N.Y.

Economizer, Fuel.

Canadian Buffalo Forge Co., Montreal.
Dominion Henderson Bearings, Limited, Toronto.
McEachren Heating and Ventilating Co., Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Man.

Electrical Instruments.

Canadian Westinghouse Co.. Hamilton.

Electrical Supplies.

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
London Mach. Tool Co., Hamilton, Ont.
John Millen & Son. Ltd., Montreal.
Packard Electric Co., St. Catharines.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Electrically Driven Tools and Machinery.

American Tool Works Co., Cincinnati.
John Bertram & Sons, Dundas.
Canada Machinery Agency, Montreal.
Canadian Westinghouse Co., Hamilton.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York,
H. W. Petrie, Toronto.
Pratt & Whitney Co , Hartford, Conn.
Williams & Wilson, Montreal

Electrical Repairs

Canadian Westinghouse Co , Hamilton.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Emery and Emery Wheels.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Emery Wheel Dressers.

Canada Machinery Agency, Montreal.
Diamond Saw & Stamping Works, Buffalo
Dominion Foundry Supply Co., Montreal and Toronto
Hamilton Facing Mill Co., Hamilton.
John Millen & Son, Ltd , Montreal.
H. W. Petrie, Toronto.
Standard Tool Co., Cleveland.

Emery Wheel Dressers, Cutters.

Diamond Saw & Stamping Works, Buffalo.

Engineers and Contractors.

Canada Foundry Co , Limited, Toronto.
Canadian White Co., Montreal.
D'Olier Engineering Co., New York.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Link-Belt Co., Philadelphia.
Miller Bros. & Toms Montreal.
The Smart-Turner Mach. Co., Hamilton.

Engineers' Supplies.

Rice Lewis & Son, Toronto.

Engines, Gas and Gasoline.

Canada Machinery Agency Montreal.
The Canadian Fairbanks Co., Montreal.
Canadian McVicker Eogine Co., Galt, Ont
Dominion Henderson Bearings, Limited Toronto.

Economic Heat, Light and Power Supply Co , Toronto.
W. Gillespie, Toronto.
The Goldie & McCulloch Co., Galt, Ont.
International Harvester Co., Chicago
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.

Engines, Steam.

Allis-Chalmers-Bullock, Limited, Montreal
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
D'Olier Engineering Co., New York.
The Goldie & McCulloch Co., Galt, Ont.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co , Montreal.
John McDougall Caledonian Iron Works Montreal.
Miller Bros. & Toms, Montreal.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.
Waterous Engine Works Co., Brantford.

Engravers.

Toronto Engraving Co., Toronto.

Exhaust Heads.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Expanded Metal.

Expanded Metal and Fireproofing Co. Toronto

Expanders.

A. B. Jardine & Co., Hespeler, Ont.

Fans, Electric.

Canadian Buffalo Forge Co., Montreal.
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.
McEachren Heating and Venti ating. Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Fans, Exhaust.

Canadian Buffalo Forge Co., Montreal
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass

Feed Water Heaters.

The Smart-Turner Mach. Co., Hamilton

Files and Rasps.

John Millen & Son, Ltd., Montreal.
Rice Lewis & Son, Toronto.
Nicholson File Co., Providence, R.I.
H. W. Petrie, Toronto.
Whitman & Barnes Mfg. Co., St. Catharines.

Fillet, Pattern.

Dominion Foundry Supply Co , Montrea and Toronto.
Hamilton Facing Mill Co , Hamilton and Montreal.

Fire, Apparatus.

Waterous Engine Works Co., Brantford.

Fire Brick and Clay.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Flash Lights.

Berlin Electrical Mfg. Co., Berlin, Ont.

Flour Mill Machinery.

Allis-Chalmers-Bullock Co., Montreal.
The Goldie & McCulloch Co., Galt, Ont.
Miller Bros. & Toms, Montreal.

Flue Rollers.

Chicago Pneumatic Tool Co., Chicago.

Forges.

Boynton & Plummer, Worcester, Mass.
Canada Foundry Co , Limited, Toronto.
Canadian Buffalo Forge Co., Montreal.
Hamilton Facing Mill Co., Hamilton and Montreal.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Forgings, Drop.

H. W. Petrie, Toronto.
St. Lawrence Supply Co., Montreal.
Whitman & Barnes Mfg. Co., St. Catharines.

Forging Machinery.

John Bertram & Sons Co , Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio
Niles-Bement-Pond Co., New York.
Western Machine Co., Stouffville, Ont

Founders.

R. McDougall Co., Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
Western Machine Co., Stouffville, Ont.

Friction Clutch Pulleys, etc.

The Dodge Mfg. Co., Toronto.
The Goldie & McCulloch Co., Galt, Ont.
Link-Belt Co., Philadelphia.
W. B. McLean & Co., Montreal.
Miller Bros. & Toms, Montreal.
Sylvester Mfg. Co,, Lindsay, Ont.

Furnaces.

Dominion Foundry Supply Co , Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Galvanizing

Canada Metal Co., Toronto.

Gas Blowers and Exhausters.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
D'Olier Engineering Co., New York.
B. F. Sturtevant Co., Hyde Park, Man.

Gas Plants, Suction.

Dominion Henderson Bearings, Limited, Toronto.
Economic Heat, Light and Power Supply Co., Toronto.
W. Gillespie, Toronto.
Sylvester Mfg. Co., Lindsay, Ont.
Wayland Williams & Dadson, Montreal.
Western Machine Co., Stouffville, Ont.

Gauges, Standard.

Brown & Sharpe, Providence, R.I.
W B. McLean & Co., Montreal.
Pratt & Whitney Co., Hartford, Conn.

Gearing.

W. B. McLean & Co., Montreal.

Gear, Cutting Machinery.

Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cincinnati.
Brown & Sharpe, Providence, R.I.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford. Conn.
Williams & Wilson, Montreal.

Gears, Angle.

Brown & Sharpe, Providence, R.I.
Chicago Pneumatic Tool Co., Chicago.
Laurie Engine & Machine Co., Montreal.
Miller Bros. & Toms, Montreal.
Waterous Engine Co., Brantford.

Gears, Reducing.

Brown & Sharpe, Providence, R.I.
Chicago Pneumatic Tool Co., Chicago.
Miller Bros. & Toms, Montreal.

Generators, Electric.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.
D'Olier Engineering Co., New York.
H. W Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Mass.

Generators, Gas.

H. W. Petrie, Toronto.

Glass Bevelling Machines.

Pendrith Machinery Co., Toronto.

Graphite Paints.

P. D. Dods & Co., Montreal.

Graphite.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Grinders, Automatic Knife.

W. H. Banfield & Son, Toronto.

Grinders, Centre.

Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinders, Cutter.

Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Millen & Son, Ltd., Montreal.
Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.

Grinders, Tool.

Armstrong Bros. Tool Co., Chicago.
B. F. Barnes Co., Rockford, Ill.
Brown & Sharpe, Providence, R.I.
H. W. Petrie, Toronto.
The Stevens Co., Galt, Ont.
Williams & Wilson, Montreal.

Grinding Machines.

Brown & Sharpe, Providence, R.I.
The Canadian Fairbanks, Montreal
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinding and Polishing Machines.

The Canadian Fairbanks Co., Montreal.
Dominion Henderson Bearings, Limited. Toronto.
John Millen & Son, Ltd., Montreal.
Miller Bros. & Toms, Montreal.
Niles-Bemont-Pond Co., New York.
H. W. Petrie, Toronto.
Pendrith Machinery Co., Toronto.

Hack Saws.

Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Diamond Saw and Stamping Works, Buffalo, N. Y.
John Millen & Son, Ltd , Montreal.
Niles-Bement-Pond Co., New York.
W. B. McLean & Co., Montreal.
H. W. Petrie, Toronto.
West Haven Mfg. Co., New Haven, Conn.
Williams & Wilson. Montreal..

Hack Saw Frames

Diamond Saw and Stamping Works, Buffalo, N.Y.
West Haven Mfg. Co., New Haven, Conn.

Hammers, Drop.

London Mach. Tool Co., Hamilton, Ont.
Miller Bros. & Toms Montreal.
Niles-Bement-Pond Co., New York.

Hammers, Rand—All Kinds.

Whitman & Barnes Mfg. Co., St. Catharines.

Hammers, Steam.

John Bertram & Sons Co. Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co , New York.

Hangers.

Dominion Henderson Bearings, Limited, Toronto.
The Goldie & McCulloch Co., Galt, Ont.
Miller Bros & Toms, Montreal.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford.
Pendrith Machinery Co., Toronto.

Hardware Specialties

Globe Machine & Stamping Co., Cleveland Ohio.

Heating Apparatus.

Canadian Buffalo Forge Co., Montreal
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., High Park, Mass.

Hoisting and Conveying Machinery.

Allis-Chalmers-Bullock, Limited, Montrea
Jenckes Machine Co., Sherbrooke, Que.
Link-Belt Co., Philadelphia.
Miller Bros. & Toms, Montreal.
Niles-Bement-Pond Co., New York.
The Smart- Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford,

Hoists, Pneumatic.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co. Chicago.
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Hose, Air.

Canadian Rand Drill Co., Montreal.
Canadian Westinghouse Co., Hamilton.
Chicago Pneumatic Tool Co. Chicago.

Hose Couplings.

Canadian Rand Drill Co., Montreal.
Canadian Westinghouse Co., Hamilton.
Chicago Pneumatic Tool Co., Chicago.
Whitman & Barnes Mfg. Co., St. Catharines.

Hose, Steam.

Allis-Chalmers-Bullock, Ltd., Montreal.
Canadian Rand Drill Co., Montreal.
Canadian Westinghouse Co., Hamilton.

Hydraulic Accumulators.

Niles-Bement-Pond Co , New York.
The Smart-Turner Mach. Co., Hamilton.

Hydraulic Machinery.

Allis-Chalmers-Bullock, Limited, Montreal
Niles-Bement-Pond Co., New York.

Indicators, Speed.

L. S. Starrett Co., Athol, Mass.

Injectors.

Canada Foundry Co., Toronto.
The Canadian Fairbanks Co., Montreal.
Rice Lewis & Son, Toronto.
Penberthy Injector Co., Windsor, Ont.

Iron Cements.

Hamilton Facing Mill Co., Hamilton and Montreal.

Iron Filler.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Iron Tools.

John Bertram & Sons Co., Dundas, Ont.
A. B. Jardine & Co , Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
H. W. Petrie, Toronto.
Th Stevens Co., Galt, Ont.

Key-Seating Machines.

B. F. Barnes Co., Rockford, Ill.
Niles-Bement-Pond Co., New York.

Lace Leather.

Sadler & Haworth, Montreal.

Lamps, Arc and Incandescent.

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The Packard Electric Co., St. Catharines.

Lathe Dogs.

Armstrong Bros., Chicago
Pratt & Whitney Co., Hartford, Conn.

Lathes, Engine.

American Tool Work Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
R. McDougall Co , Galt, Ont.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.

Lathes, Foot-Power.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.

Lathes, Screw Cutting.

B. F. Barnes Co., Rockford, Ill.
Niles-Bement-Pond Co., New York.

Lathes, Automatic, Screw-Threading.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Bench.

B. F. Barnes Co., Rockford, Ill.
London Mach. Tool Co., London, Ont.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Turret.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
R. McDougall Co., Galt, Ont.
The Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.
Warner & Swasey Co., Cleveland, O.

Lathes, Buffing and Polishing.

Pendrith Machinery Co., Toronto.

Lathes, Metal Spinning.

Pendrith Machinery Co., Toronto.

Leather Belting.

Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
The Dodge Mfg. Co., Toronto.

Lime Stone Flux.

Hamilton Facing Mill Co., Hamilton and Montreal.

Locomotives, Air.

Canadian Rand Drill Co., Montreal.

Locomotives, Electrical.

Canadian Westinghouse Co., Hamilton

Locomotives, Steam.

Canada Foundry Co., Toronto.
Canadian Rand Drill Co., Montreal.

Lubricator, Plumbago.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Lumber Dry Kilns.

Canadian Buffalo Forge Co., Montreal
McEachren Heating and Ventilating Co , Galt, Ont.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Machinery Dealers.

Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Dominion Henderson Bearings, Limited, Toronto.

Miller Bros. & Toms, Montreal.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
St. Lawrence Supply Co., Montreal.
Williams & Wilson Montreal.

Machinery Designers.

Dominion Henderson Bearings, Limited, Toronto.

Machinists.

W. H. Banfield & Sons, Toronto.
The Dodge Mfg. Co., Toronto.
Dominion Henderson Bearings, Limited, Toronto.
Link-Belt Co., Philadelphia.
Miller Bros. & Toms Montreal.
Pendrith Machinery Co., Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford.

Machinists' Small Tools.

Armstrong Bros., Chicago.
Brown & Sharpe, Providence, R.I
Butterfield & Co., Rock Island, Que.
Diamond Saw and Stamping Works, Buffalo, N. Y.
Rice Lewis & Son, Montreal.
Pratt & Whitney Co , Hartford, Conn.
Standard Tool Co., Cleveland.
L. S. Starrett Co., Athol, Mass.
Williams & Wilson, Moutreal.

Mailing Weights.

A. B. Jardine & Co., Hespeler, Ont.

Mandrels.

Brown & Sharpe, Providence, R.I.
A. B. Jardine & Co., Hespeler, Ont.
Miller Bros & Toms, Montreal
The Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg. Co., St. Catharines.

Measuring Machines.

The Pratt & Whitney Co., Hartford, Conn.

Mechanical Draft.

Canadian Buffalo Forge Co., Montreal.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Metallic Paints.

P. D. Dods & Co., Montreal.

Meters, Electrical.

Canadian Westinghouse Co., Hamilton.

Mill Machinery.

The Dodge Mfg. Co., Toronto.
The Goldie & McCulloch Co., Galt, Ont.
Jenckes Machine Co., Sherbrooke, Que.
H. W. Petrie, Toronto.
Waterous Engine Co., Brantford.
Williams & Wilson, Montreal.

Milling Attachments.

Becker-Brainard Milling Machine Co. Hyde Park, Mass.
John Bertram & Sons Co., Dundas, Ont.
Brown & Sharpe, Providence, R.I.
Niles-Bement-Pond Co., New York,
Pratt & Whitney, Hartford, Conn.
The Stevens Co., Galt, Ont.

Milling Machines, Horizontal.

Becker-Brainard Milling Machine Co., Hyde Park, Mass.
John Bertram & Sons Co., Dundas, Ont.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
Pratt & Whitney, Hartford, Conn.

Milling Machines, Plain.

American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co. Hyde Park, Mass
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Milling Machines, Universal.

American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Milling Machines, Vertical.

Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Milling Tools.

Wm. Abbott, Montreal.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
Dominion Henderson Bearings, Limited, Toronto.
Geometric Tool Co., New Haven, Conn.
London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
The Stevens Co., Galt, Ont.

Mining Machinery.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
The Dodge Mfg. Co., Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Miller Bros. & Toms, Montreal.
T. & H. Electric Co. Hamilton.

Mixing Machines, Dough.

Pendrith Machinery Co., Toronto.

Mixing Machines, Special.

Pendrith Machinery Co., Toronto.

Model Tools.

Dominion Henderson Bearings, Limited, Toronto.
Globe Machine & Stamping Co , Cleveland Ohio.
The Stevens Co., Galt, Ont.
Wells Pattern and Model Works, Toronto

Motors, Electric.

Allis-Chalmers-Bullock Limited, Montreal
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The Packard Electric Co., St. Catharines.
B. F. Sturtevant Co., Hyde Park, Mass.
T. & H. Electric Co., Hamilton.

Motors, Air.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Molders' Supplies.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Molders' Tools.

Domiuion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Molding Sand.

T. W. Barnes, Hamilton, Ont.
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Nippers, Stay Bolt.

Chicago Pneumatic Tool Co., Chicago.

Nut Tappers.

John Bertram & Sons Co., Dundas, Ont
A. B. Jardine & Co., Hespeler.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.

Oatmeal Mill Machinery.

The Goldie & McCulloch Co., Galt

Oils, Core.

Dominion Foundry Supply Co , Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Painting Machines, Pneumatic.

Chicago Pneumatic Tool Co., Chicago.

Patent Solicitors.

Hanbury A. Budden, Montreal.
Fetherstonhough & Blackmore, Montreal
Fetherstonhaugh & Co., Montreal.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

Patterns.

John Carr, Hamilton.
The Dodge Mfg. Co., Toronto.
Hamilton Pattern Works, Hamilton.
Miller Bros. & Toms Montreal.
The Stevens Co., Galt, Ont.
Wells' Pattern and Model Works, Toronto.

Pipe Cutting and Threading Machines.

Butterfield & Co., Rock Island, Que.
Canada Machinery Agency, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York.

Planers, Portable.

H. B. Underwood Co., Philadelphia.

Planers, Standard.

American Tool Works, Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Poud Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Planers, Rotary.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Power Hack Saw Machines.

Diamond Saw and Stamping Works, Buffalo, N. Y.

Power Plants.

The Smart-Turner Mach. Co., Hamilton.

Planing Mill Fans.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Man.

Plug Drillers, Pneumatic.

Canada Foundry Co., Limited, Toronto.
Canadian Rand Drill Co., Montreal.

Plumbago.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Pneumatic Tools.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago
Hamilton Facing Mill Co., Hamilton.

Presses, Drill.

American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.

Presses, Drop.

W. H. Banfield & Son, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Canada Machinery Agency, Montreal.
Miller Bros. & Toms, Montreal.
Niles-Bement-Pond Co., New York

Presses, Hand.

E. W. Bliss Co., Brooklyn, N.Y.

Presses, Hydraulic.

Jenckes Machine Co., Sherbrooke, Que.
John Bertram & Sons Co., Dundas, Ont.
Laurie Engine & Machine Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Miller Bros. & Toms. Montreal.
Niles-Bement-Pond Co., New York.

Presses, Power.

E. W. Bliss Co., Brooklyn, N.Y.
Canada Machinery Agency, Montreal.
Jenckes Machine Co., Sherbrooke, Que.
London Mach Tool Co., Hamilton. Ont.
Niles-Bement-Pond Co., New York.

Pulp Mill Machinery.

Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.

Pulleys.

Canada Machinery Agency, Montreal
The Canadian Fairbanks Co., Montreal.
The Dodge Mfg. Co., Toronto.
Dominion Henderson Bearings, Limited, Toronto.
The Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Link-Belt Co., Philadelphia
Miller Bros. & Toms, Montreal.
Pendrith Machinery Co., Toronto.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Williams & Wilson. Montreal.
Waterous Engine Co., Brantford.

Pumps, Steam.

Allis-Chalmers-Bullock, Limited, Montreal
Canada Foundry Co., Toronto.
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co , Montreal.
D'Olier Engineering Co., New York.
Dominion Henderson Bearings, Limited, Toronto.
The Goldie & McCulloch Co., Galt.
John McDougall Caledonian Iron Works, Montreal.
R. McDougall Co., Galt, Ont.
H. W. Petrie, Toronto.
St. Lawrence Supply Co., Montreal.
The Smart-Turner Mach. Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.
Waterous Engine Co., Brantford.

Pumping Machinery.

Canada Foundry Co., Limited, Toronto
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
D'Olier Engineering Co., New York.
Dominion Henderson Bearings, Limited, Toronto.
Laurie Engine & Machine Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
St. Lawrence Supply Co., Montreal.
The Smart-Turner Mach. Co., Hamilton.

Punches and Dies.

W. H. Banfield & Sons, Toronto.
Butterfield & Co., Rock Island.
Dominion Henderson Bearings, Limited, Toronto.
Globe Machine & Stamping Co.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Miller Bros. & Toms, Montreal.
Pratt & Whitney Co., Hartford, Conn.
H. W. Petrie, Toronto.

Punches, Hand.

Canadian Buffalo Forge Co., Montreal

Punches, Power.

John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Punches, Turret.

London Mach. Tool Co., London, Ont
Taylor & McKenzie, Guelph.

Punching Machines, Horizontal.

John Bertram & Sons Co , Dundas, Ont.
London Mach. Tool Co., Hamilton Ont.
Niles-Bement-Pond Co., New York

Quartering Machines.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.

Rapping Plates.

Hamilton Facing Mill Co., Hamilton and Montreal.

Reamers.

Wm. Abbott, Montreal.
Brown & Sharpe, Providence, R.I.
Butterfield & Co., Rock Island.
A. B. Jardine & Co., Hespeler, Ont.
John Millen & Son, Ltd., Montreal.
Morse Twist Drill and Machine Co., New Bedford, Mass
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
The Stevens Co., Galt, Ont.
Whitman & Barnes Mfg. Co., St. Catharines.

Reamers, Steel Taper.

Butterfield & Co., Rock Island.
Chicago Pneumatic Tool Co., Chicago.
A. B. Jardine & Co., Hespeler, Ont.
John Millen & Son, Ltd., Montreal.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg. Co., St. Catharines.

Rheostats.

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
T. & H. Electric Co., Hamilton,

Riveters, Hydraulic.

London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Rolls, Bending.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Rotary Converters.

Allis-Chalmers-Bullock, Ltd., Montreal.
Canadian Westinghouse Co., Hamilton

Safes.

The Goldie & McCulloch Co., Galt, Ont.

Sand, Bench.

Albany and North River Moulding Sand Co., Albany, N.Y.

Sand Blast Machinery.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Hamilton Facing Mill Co., Hamilton and Montreal.

Sand, Brass.

Albany and North River Moulding Sand Co , Albany, N Y.

Sand, Heavy, Grey Iron.

Albany and North River Moulding Sand Co., Albany, N.Y.

Sand, Malleable.

Albany and North River Moulding Sand Co., Albany, N.Y.

Sand, Medium Grey Iron.

Albany and North River Moulding Sand Co., Albany, N.Y.

Sand, Plate.

Abany and North River Moulding Sand Co., Albany, N.Y.

Sand Sifters.

Dominion Foundry Supply Co., Montreal and Toronto
Hamilton Facing Mill Co., Hamilton.

Here in Canada we talk a lot about

"The Importance of Cheap Power to the Manufacturers"

AND WE SPEND A LOT OF MONEY ON PARLIAMENTARY COMMISSIONS

AND A LOT OF PRINTERS' INK IN NEWSPAPER ARTICLES

AND A LOT OF BREATH IN TALK.

But with few exceptions we have not begun **TO DO** what they have been doing for years in Europe, viz:

USE PRODUCER GAS

AND A GOOD GAS ENGINE

READ LETTER FROM SIMONDS CANADA SAW WORKS

MONTREAL, QUE., July 30th, 1906.

Canadian Agents
of Campbell Gas Engines and Suction Gas Plants.

GENTLEMEN,—

It gives us great pleasure to inform you that the 50-H.P. Campbell Gas Engine and Suction Gas Plant which you supplied us with 6 months ago is operating in a very satisfactory manner.

The fuel costs are only about 90c. per day of 10 hours; this means that we are getting 50 H. P. for 9c. worth of fuel per hour.

The water consumption is insignificant, and altogether the economy of the Plant has been a matter of great surprise to us, and we believe exceeds what you claimed for it when you were negotiating the sale to us.

It is the excellent behaviour of this Engine and Plant and its economy that decided us to place the order with you for the 150 H.P. Engine and 600 H. P. Gas Plant, which you have on the way for us

We also appreciate very fully the prompt attention you have always given to all our enquiries and the manner in which you have helped us over the difficulties we experienced in the installing, owing to the peculiar nature of the ground here, and also in advising us regarding the carrying of the very heavy overload which we have frequently to throw upon the Engine.

Wishing you every success we are, Yours very truly,

SIMONDS CANADA SAW COMPANY, Limited.
B. M. FEENY, Mgr.

This means that this firm are getting power at a fuel cost of

Less than $6.00

per H.P. per annum.

Now What is the use of talking about Niagara Power at **$20** per year when for a moderately small outlay you can get power at a price they cannot touch?

WRITE THE **Producer Gas Co.,** 11 FRONT ST. E., TORONTO

DO IT NOW

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Albany and North River Moulding Sand Co., Albany, N.Y.

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A. B. Jardine & Co., Hespeler, Ont.
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ALPHABETICAL INDEX.

A

Abbott, Wm. 81
Albany and North River Moulding sand Co. 78
Allis-Chalmers-Bullock Co. ..... Outside back cover
American Tool Works Co 5
Armstrong Bros. Tool Co. 87

B

Barnes, T. W. 79
Barnes, B. F., Co. 3
Banfield, W. H., & Sons 18
Becker-Brainard Milling Machine Co. 4
Berlin Electrical Mfg. Co. 15
Bertram, John, & Sons ..... front cover
Bickford Drill & Tool Co. 5
Bliss, E. W., Co. 18
Brandeis, Charles 71
Brown & Sharpe Mfg. Co. 83
Budden, Hanbury A. 71
Butterfield & Co. 85

C

Canada Foundry Co. 64
Canada Machinery Agent 64
Canada Metal Co 82
Canadian Pneumatic Tool Co 85
Canada Chemical Mfg. Co. 14
Canadian Buffalo Forge Co. 9
Canadian Fairbanks Co. 20
Canadian McVicker Engine Co 76
Canadian Rand Drill Co. 83
Canadian Westinghouse Co. 1
Carr, John 77
Chadwick Bros 79
Chapman Double Ball-Bearing Co. 12
Clark-Demill Co. 6
Cleveland Automatic Mach. Co. 9

D

DeCew, J. A. 71
Detroit Testing Laboratory 71
De Clercy, Jules 71
Diamond Saw and Stamping Works 82
Dillon A. & Son 77
Dodge Mfg. Co 13
Dods, P. D. & Co. 75
Dominion Foundry Supply Co 79
Dominion Henderson Bearings 12
D'Olier Engineering Co. 15
Dominion Belting Co. 74

E

Economical Mfg. and Supply Co 15
Economic Power, Light and Heat Supply Co. 76
Electric Blue Print Co. 71
"Electrical Times" 79
"Engineering" ..... inside back cover
Engineering Specialties Co 74
"Engineering Times" 82
Expanded Metal and Fireproofing Co. 81

F

Fetherstonhaugh & Co. 71
Fetherstonhaugh & Blackmore 71
Fielding, John S. 71

G

Gibb, Alex. 81
Gillespie, W. 77
Geometric Tool Co. 86
Globe Machine & Stamping Co. 80
Goldie & McCulloch Co. 1
Greening, B., Wire Co. 75

H

Hamilton Facing Mills Co 78
Hamilton Pattern Works 77
Hart Mfg Co. 80
Howard, Geo. H. 9

I

International Harvester Co. 76

J

Jardine, A. B., & Co. 80
Jenckes Machine Co. 15
Jessop, Wm., & Sons 80

K

Ker & Goodwin 18
Kerr Turbine Co. 14

L

Laurie Engine and Machine Co. 14
Leonard, E., & Son 74
Lewis, Rice, & Son 87
Link-Belt Co. 18
London Machine Tool Co. 2

M

Manitoba Iron Works 16
McDougall, R., Co 6
McDougall, John, Caledonian Iron Wks 11
McEachern Heating & Ventilating Co. 9
McLean, W. B. & Co. 7
Marion & Marion 71
Merrell Mfg. Co. 73
Millen, John, & Son 6
Miller Bros. & Toms 74
Morrow, John, Machine Screw Co. 81
Morse Twist Drill and Machine Co. 81
Morton, B. K. & Co. 80

N

National Machinery Co 74
New Process Twist Drill Co. 74
Nicholson File Co. 81

O

Osborn Mfg. Co. 79
Otis-Fensom Elevator Co. inside back cover

P

Packard Electric Co. ..... inside back cover
Parke, Roderick J. 71
Penberthy Injector Co. 82
Pendrith Mach. Co. 74
Petrie, H. W 19
Plews & Trimingham 71
Potter & Johnston Machine Co 9
Pratt & Whitney Co. ..... inside front cover
Pringle, T., & Son 71
Producer Gas Co. 69

R

Remington Typewriter Co. 15
Ridout & Maybee 71
Robb Engineering Co. 11
Royce, James C. 71

S

Sadler & Haworth 70
Sheldons Limited 8
Smart-Turner Machine Co. 64
Standard Bolt and Screw Co 81
Standard Tool Co 85
Starrett, L. S., Co. 84
St. Clair Bros. 77
Stevens Co. of Galt 3
St. Lawrence Supply Co. 73
Sturtevant, B. F., Co. 8
Sylvester Mfg. Co. 77

T

Taylor & McKenzie 74
Technical Pub. Co. 87
Toronto Engraving Co. 10
Toronto and Hamilton Electric Co 75
Toronto Plate Glass Importing Co. 74

U

Underwood, H. B., & Co. 19
Union Drawn Steel Co. 4

V

Volta Electric Repair Works 83

W

Warner & Swasey Co. 3
Waterous Engine Works Co. 16
Wayland Williams & Dadson 78
West Haven Mfg. Co. 18
Wells Pattern & Model Works 77
Western Machine Co 78
Williams & Wilson 17
Whitman & Barnes 84

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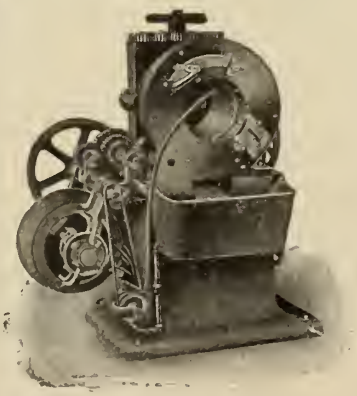

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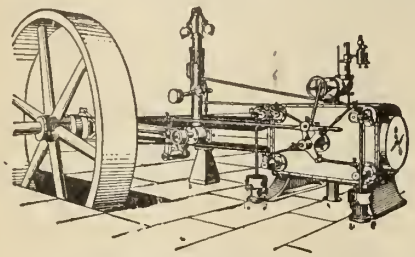

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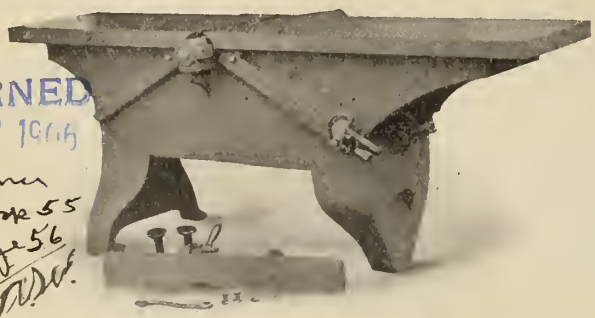

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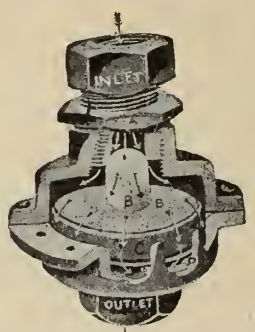

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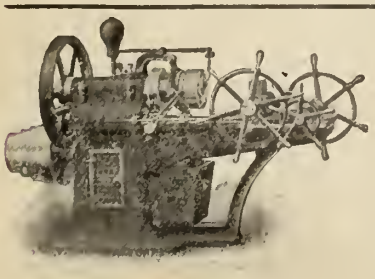

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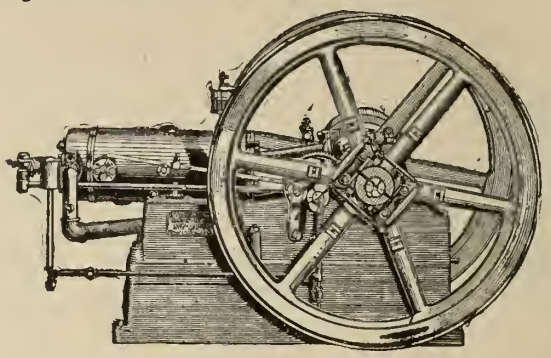

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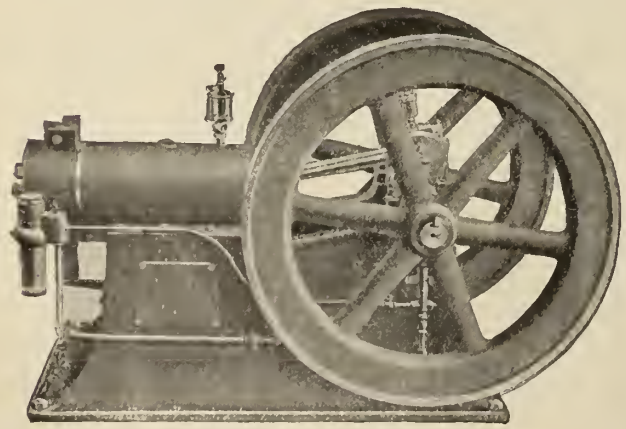

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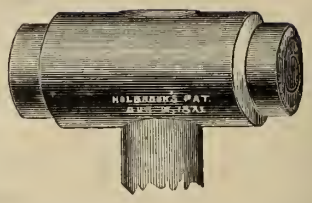

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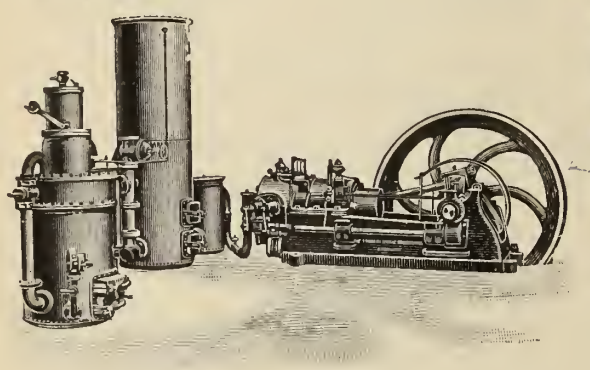

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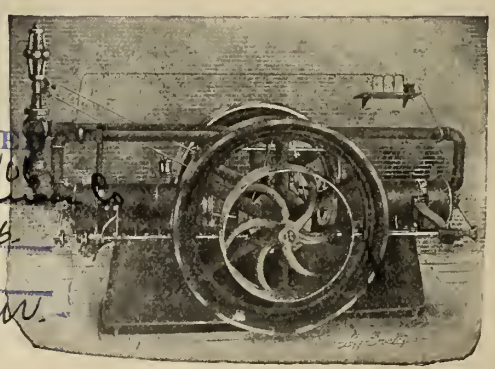

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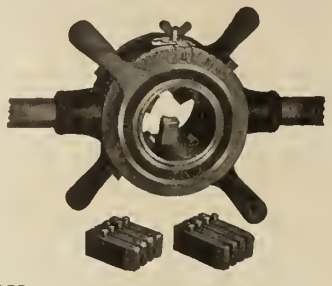

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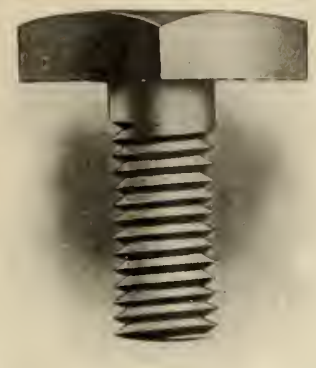

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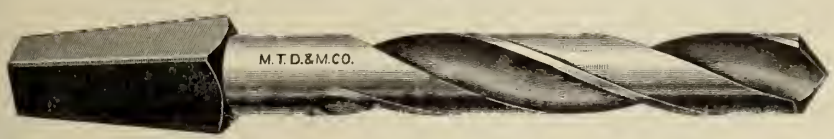

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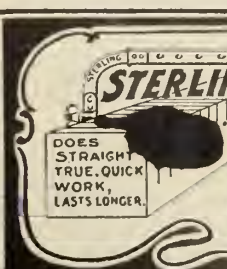

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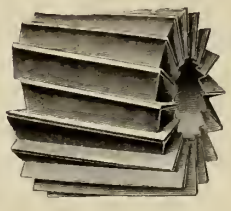

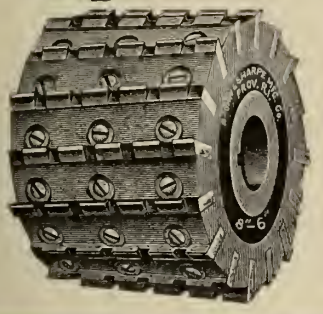

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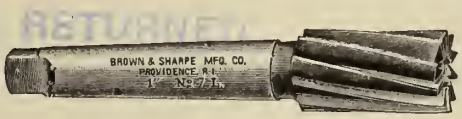

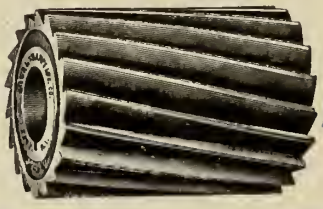

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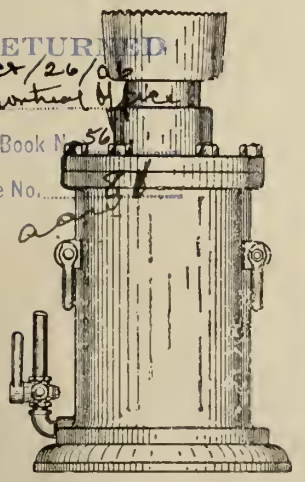

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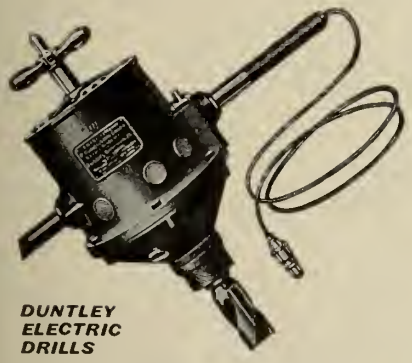

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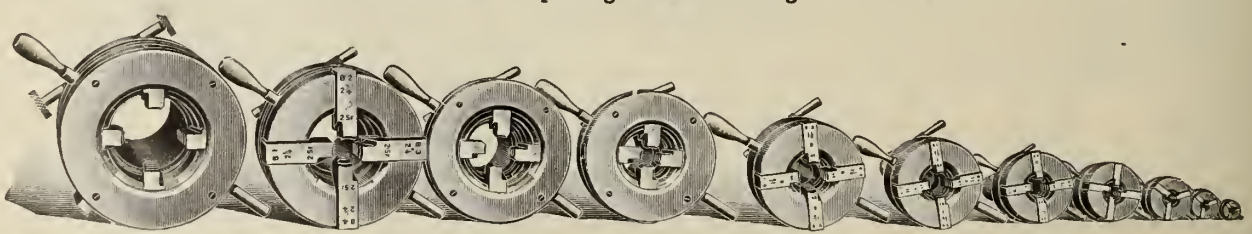

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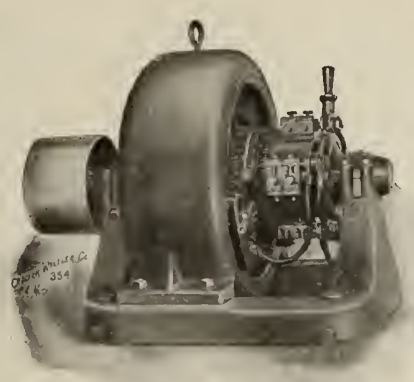

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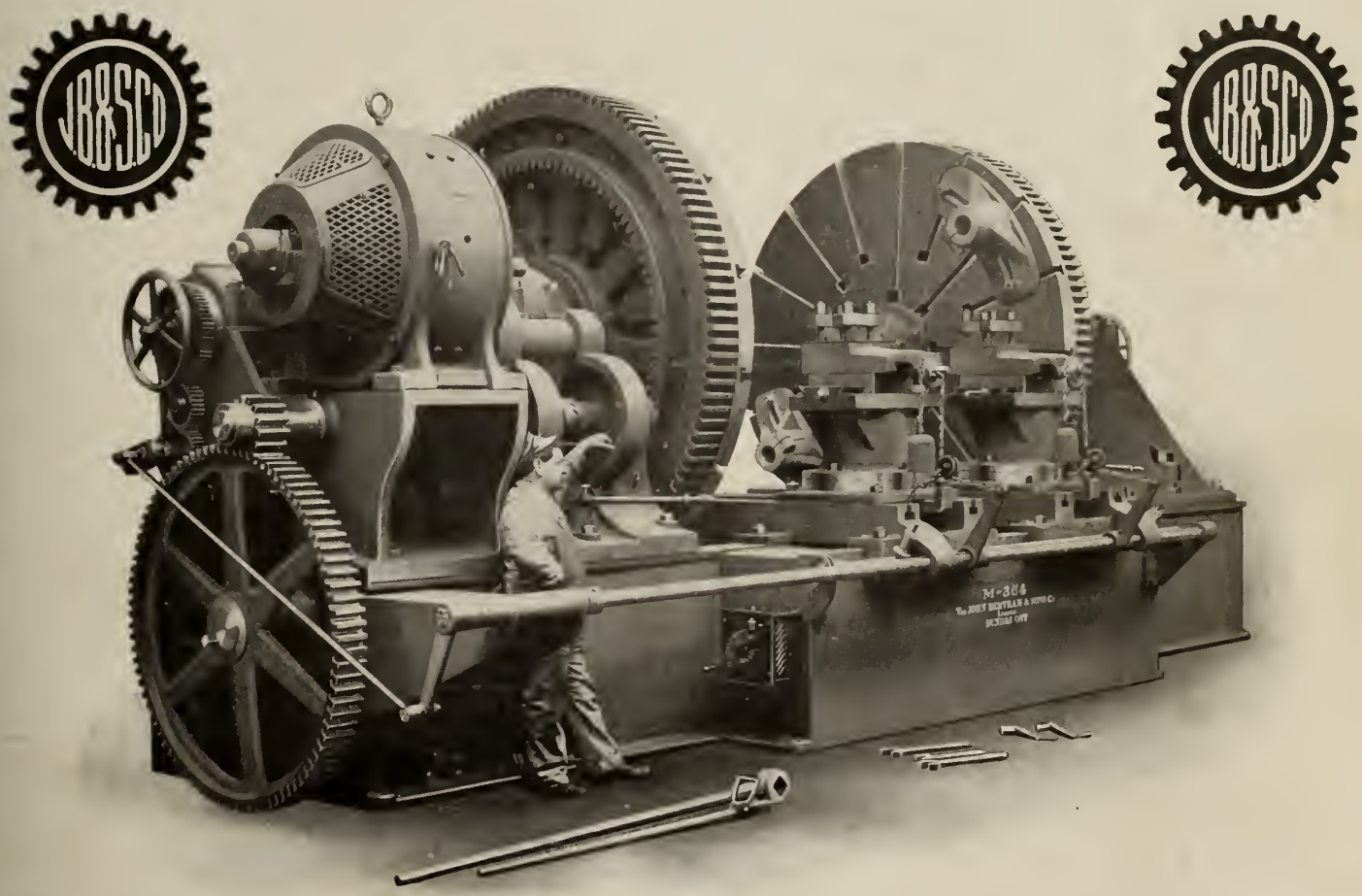

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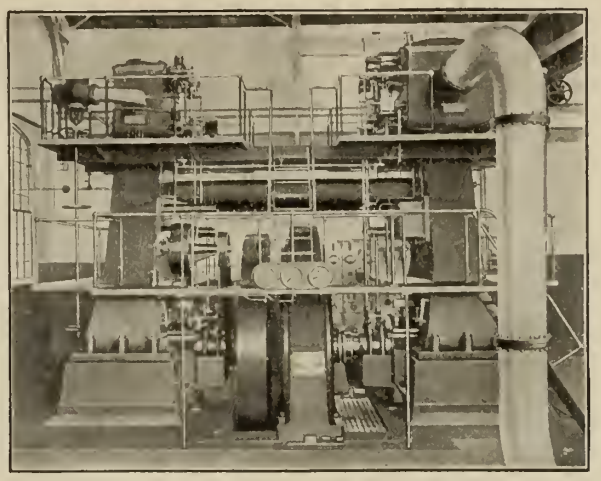

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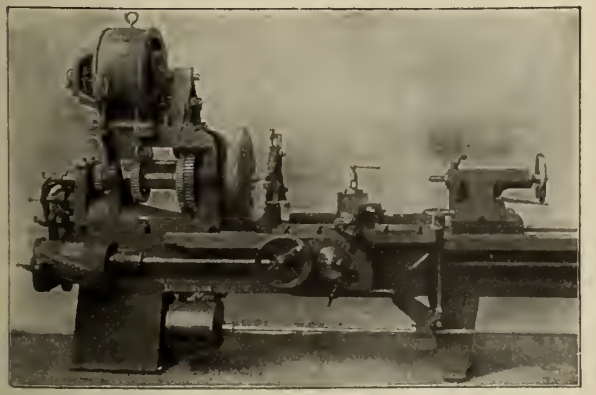

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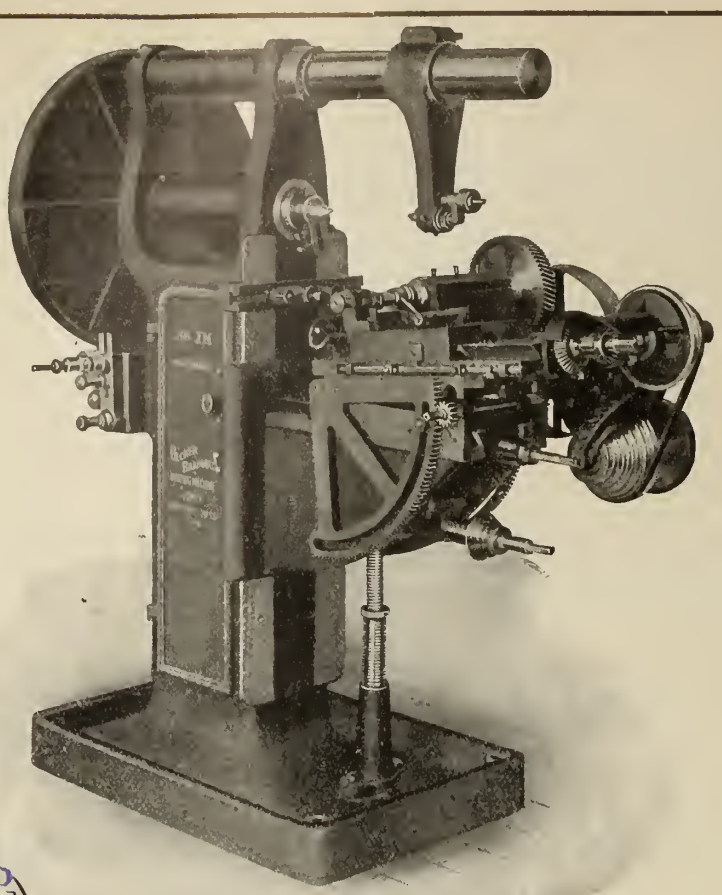

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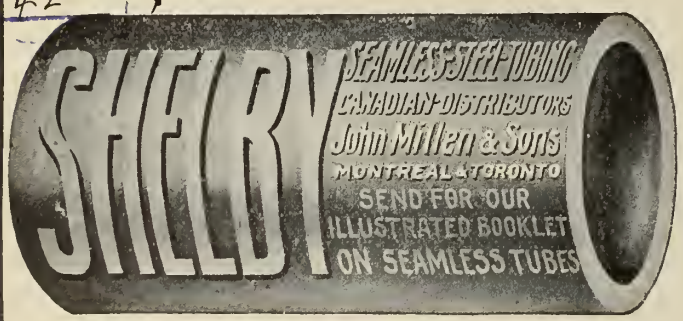

SEAMLESS STEEL TUBES

are invaluable for general Machine Shop Work.

PROMPT DELIVERY

Can be made out of our own stock, of most sizes and gauges.

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COLD DIE-ROLLED STEEL and IRON

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Pump Rods, Piston Rods, Roller Bearing Rods and Screw Steel.

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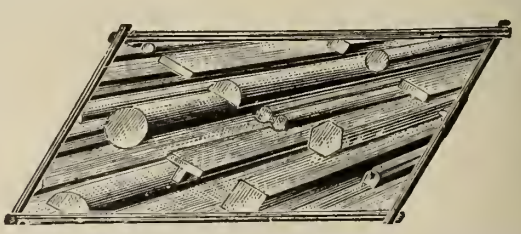
True to size and highly polished.



UNION DRAWN STEEL COMPANY Limited

HAMILTON, Canada.

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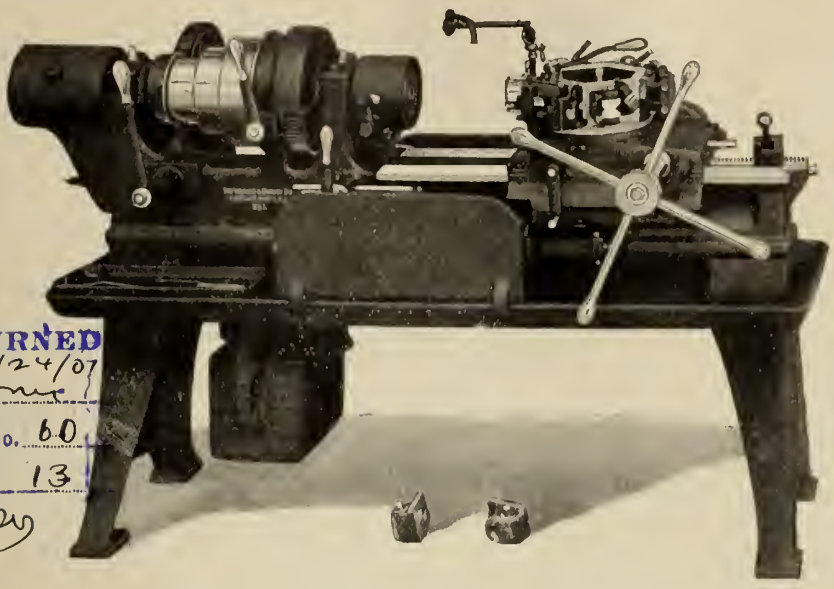
THE HOLLOW HEXAGON TURRET LATHE



is built in sizes for every requirement—each size is BEST adapted for work strictly within its range. No. 1 here illustrated for small work 1½ x 18-in., or smaller—Larger sizes for larger work.

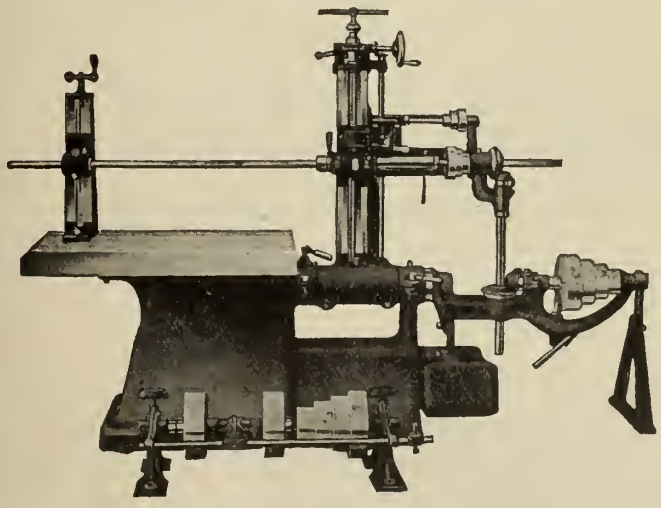
Particulars of this and other sizes will be sent upon request and should interest you.

The Warner & Swasey Company

CLEVELAND, OHIO, U.S.A.

TURRET LATHES. SCREW MACHINES. BRASS-WORKING MACHINE TOOLS.

HORIZONTAL BORING, DRILLING and TAPPING MACHINE



This is a very useful and handy Machine for any shop having long work that cannot be handled under an upright drill.

It is also well adapted for boring cylinders and other work. Will tap holes up to 1¼" in cast iron.

Complete details in Catalogue N. If interested write us.

Ontario Agent

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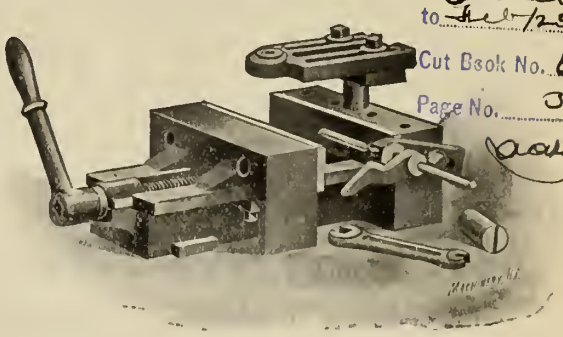

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UNIVERSAL DRILL JIG VISE

Patented 1901

MADE IN THREE SIZES

We also manufacture Milling Machine Vises, Bench Vises and Pattern-maker's Universal Vises.

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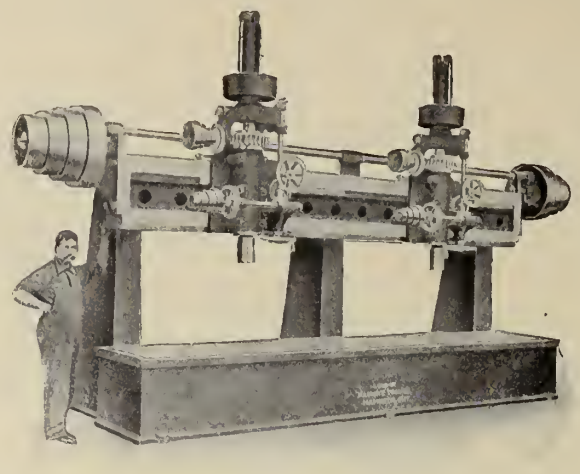


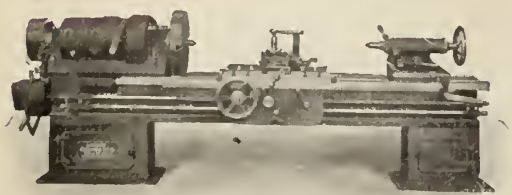
Duplex Rod Boring Machine

LONDON MACHINE TOOL CO., LIMITED

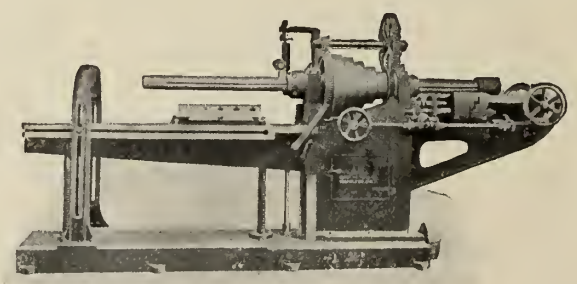
HAMILTON, CANADA

Manufacturers of

HIGH GRADE MACHINE TOOLS



22-in. All Geared Lathe



60 Horizontal Boring Mill

LONDON MACHINE TOOL COMPANY

LIMITED

HAMILTON, CANADA,

beg to announce, that they have opened an office in the new Traders Bank Building, Toronto, Canada. This office will handle the sales of the Company, and will be in charge of Mr. A. E. Juhler.

The Company will handle other lines besides its own product, and at present are selling agents in Canada for a number of American concerns, amongst whom are:

The Sibley Machine Tool Co., Southbend, Ind.
MANUFACTURERS OF UPRIGHT DRILLS

The Mueller Machine Tool Co., Cincinnati, O.
MANUFACTURERS OF RADIAL DRILLS

The Von Wyck Machine Tool Co., Cincinnati, O.
MANUFACTURERS OF LATHES

The Kempsmith Mfg. Co., Milwaukee, Wis.
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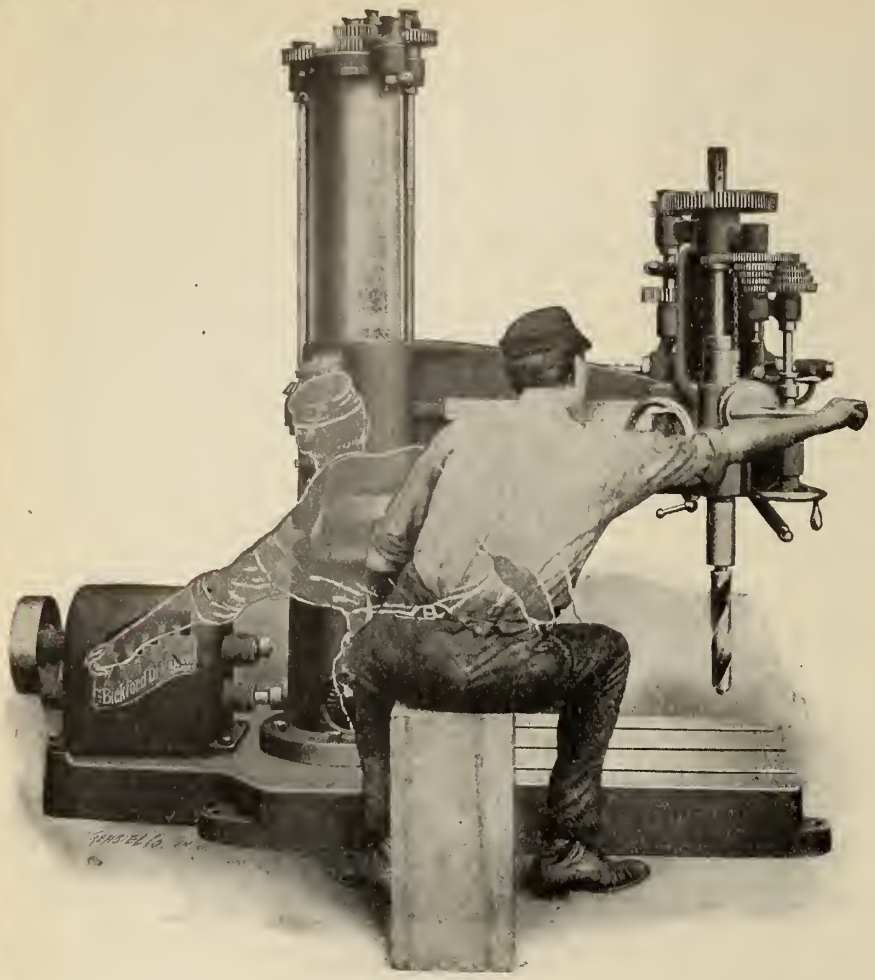
MANUFACTURERS OF YANKEE DRILL GRINDER

The London Machine Tool Company at their new plant in Hamilton are prepared to do the best and most exacting work in the line of Machine Tools, and earnestly solicit your enquiries and eventual orders.



The Lever You Want Right At Your Finger-Tips

Stop running "round to the back of your machine for a lever that you use from 1 to 20 times a day.

Everything Within Easy Reach of the Operator

This is what we claim for this new 30" **BICKFORD RADIAL**—in fact for all our Radials. And we can prove it, too, not by argument or glib assertion, but by actual demonstration. Look at the cut—did you ever see a handier, neater or more stockily built Radial in your life?

And it's just the thing for taking care of the ordinary work as found in the average shop—it was built for that purpose, you know.

Then, again, we want you to put in the little Radial in place of the large Upright you were thinking of buying. It doesn't cost much more, has infinitely greater productive capacity and will out-last and out-drill any Upright ever built.

It's made in three lengths of arms, remember, 30", 36", and 42".

Circulur 1-A. Shall we send it?

The Bickford Drill and Tool Co.

Cincinnati, Ohio, U.S.A.

FOREIGN AGENTS—Schuchardt & Schutt, Berlin, Vienna, Stockholm, St. Petersburg, New York. Alfred H. Schutte, Cologne, Brussels, Liege, Paris, Milan, Bilbao, New York. Charles Churchill & Co., Ltd., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow.
CANADIAN AGENTS—H. W. Petrie, Toronto; Williams & Wilson, Montreal.

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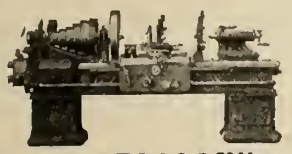
TOOLS ARE PROFIT PRODUCERS



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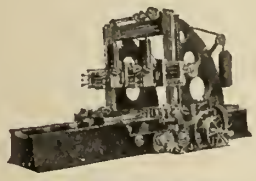
QUICK CHANGE GEAR
CONE HEAD LATHES
14-in. to 62-in. SWING



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1, 2 or 4 SPEEDS
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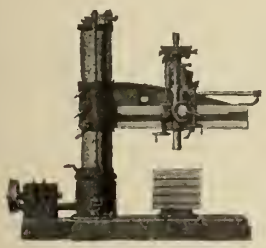


"AMERICAN"
RADIAL DRILLS
MOST POWERFUL BUILT
2½-ft. to 7-ft. ARM

ALL "AMERICAN" TOOLS

are of the most advanced type, and work to the limit the Best High Speed Steels.

They are strongly proportioned, powerful, accurate, run smoothly, operate quickly, and are easy to handle.

Each particular type is built in a special department, under the personal supervision of a particular expert in the line.

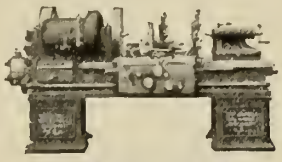
The manufacture of each machine is accomplished through a complete system of jigs, templates, etc., insuring accuracy and uniformity.

If you are wedded to the "good old way" of doing things you don't want "American Tools."

If you believe in doing things in the "new way" with the maximum of Speed, Feed and Power, you need an "American" in your shop.

The quality of material and workmanship is the highest, and the price is right.

We want your business. The benefit will be mutual.



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"Patented"
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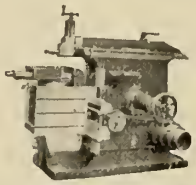

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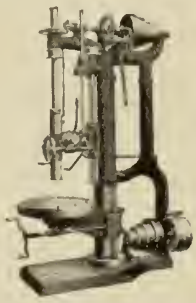

"AMERICAN"
DRILL PRESSES
WITH GEARED FEED
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"AMERICAN" TOOLS HOLD THE RECORD FOR PRODUCTION, AND INCREASE YOUR OUTPUT WITHOUT INCREASING YOUR OPERATING EXPENSES. THIS MEANS MONEY IN YOUR POCKET.

THE AMERICAN TOOL WORKS CO.
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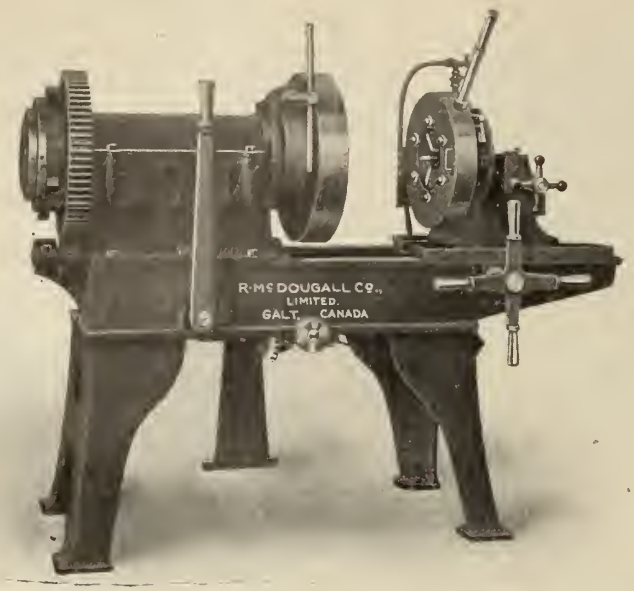

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Our tools are built just considerably better than the usual custom, in fact it is **Machine Tool** Workmanship all through. We make Lathes and Planers and the same workmen build our **Pipe Machines** so you receive the benefit. We have ready for immediate shipment—

1—6" and 3—4" Machines

McDougall Tools are Standard Tools

Yes, we have circulars

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Which Would You Choose, Fan or Chimney?

Installation at Swansea, England.

The fan replaced a chimney similar to that shown in the back-ground.

The fan required but a few days to erect. How about the chimney.

The fan is not affected by wind or weather. How about the chimney?

The fan can be utilized elsewhere? How about the chimney?

Both plants were running when the photograph was taken. Why the difference in smoke?

Our treatise No. 110 answers many questions like these. It may be had for the asking.

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THE ESSENTIAL FACTOR OF ADVANCED BOILER PLANTS

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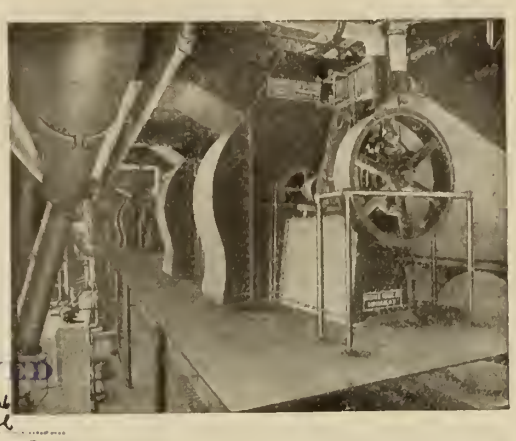
No tall Chimneys
Smoke Nuisance Abated
Perfect Draft on Damp Days.
Cheaper Grade of Coal Burned with Best Results.



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Unvarying Boiler Pressure by Automatically Controlled Fan Speed.
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WE MAKE A FULL LINE OF

Steel Plate Fans, Cupola Blowers
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Forges, Dry Kiln Trucks, etc.
Steam Traps, Exhaust Heads
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A Centralized Apparatus which is under one man's control;
The Heater is specially adapted to the use of *Exhaust Steam;*
The Heating can be accomplished with rapidity;
The Heater is enclosed in a *Fire-proof* casing;
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Constant Temperature can be maintained, and air volume varied when hot and cold system is adopted;
Ventilation is positive;
Air Volume is under control;
No Noise.

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HEATING AND VENTILATING

Hot Blast Heating Systems for buildings of all sizes.
Patent Steam Heaters that give fully 25 per cent. more efficiency than others in the market.
Planing Mill Exhausters and ***Dust Separators*** of improved patterns.
Drying Systems for material of every description, blast system or otherwise.
Fans and Blowers for all purposes.

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We Make Roller Bearings That Roll

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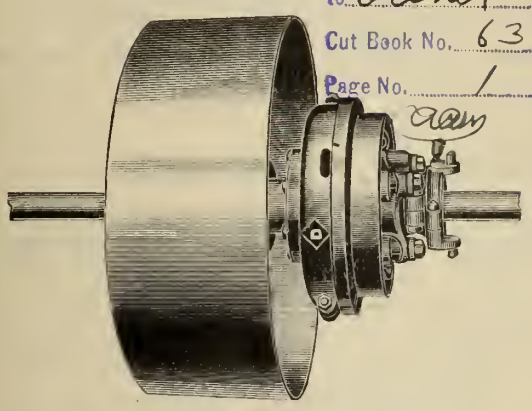

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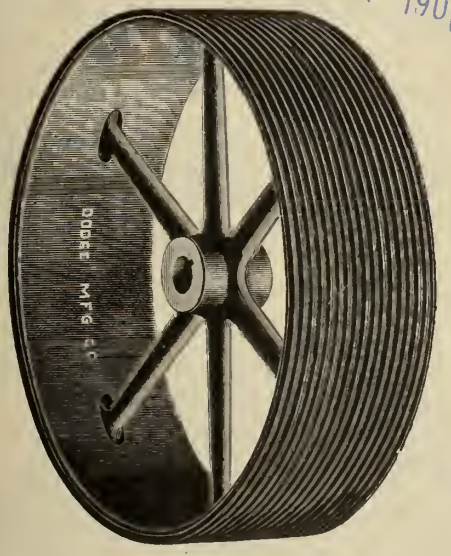

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We make them in all sizes. We have exceptionial facilities for quick shipment.

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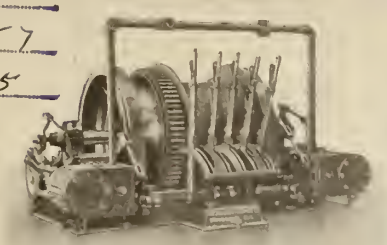

Special Cableway Hoist

This hoist was especially designed for Cableway Service, and for this class of work is unsurpassed. Its strong point is the rapid handling of a heavy load. It is a money saver. Full particulars on request.

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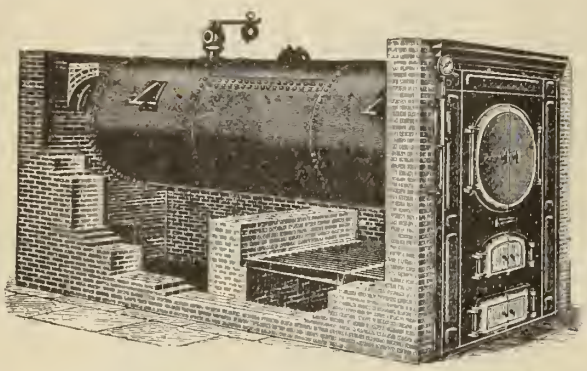

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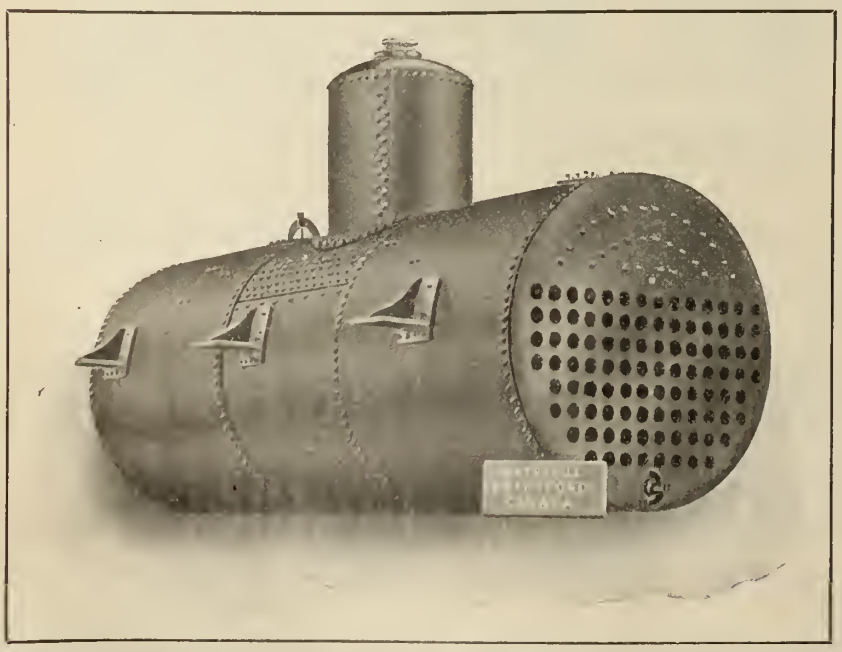

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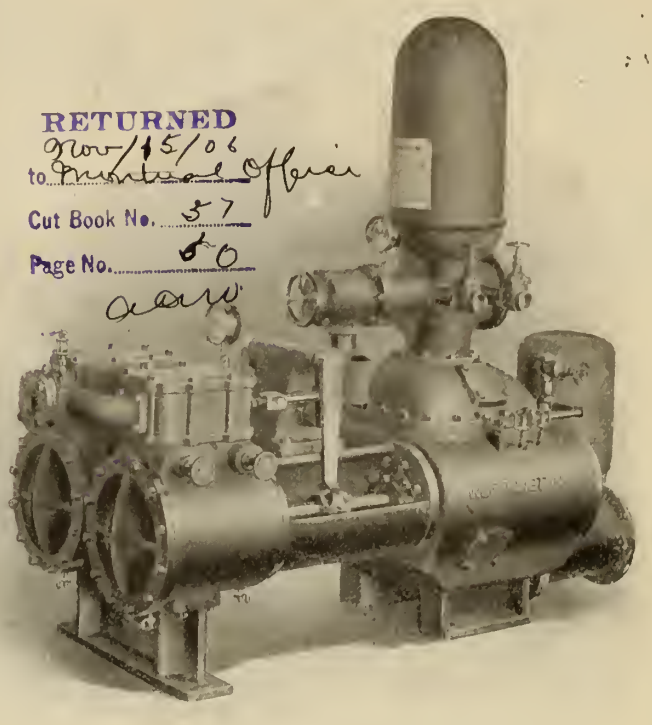
Saw Mill and Pulp Mill Machinery, Engines, Boilers, Fire Apparatus, Brick Machinery, Elevator and Conveyor Machinery, Chain, Belting, etc.

Write us for full particulars, prices and catalogues.

Worthington 1,000 Gallon Underwriters Fire Pump

The Underwriters can only outline the design—the quality of the Pump remains with the makers, depending entirely upon their experience and shop facilities, also reputation.



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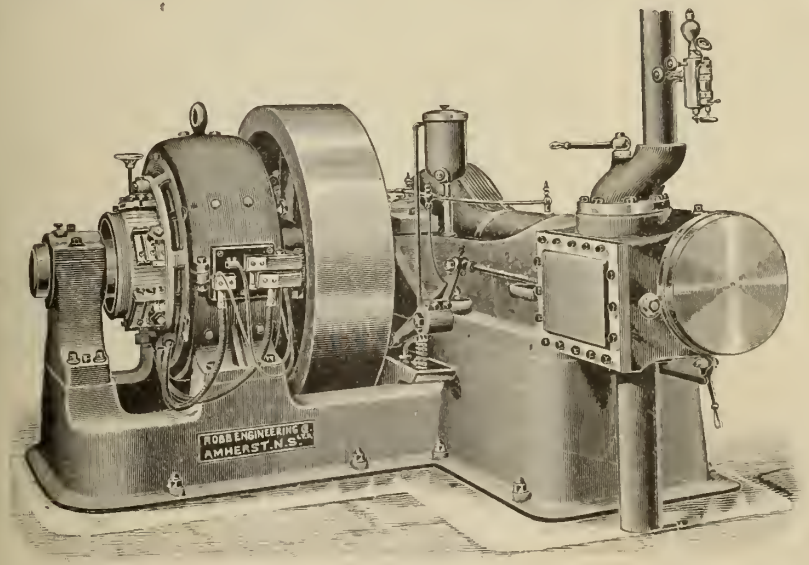
The John McDougall Caledonian Iron Works Co., Limited

Builders In Canada for Worthington Turbine Pumps

MONTREAL, P.Q.

Not One Cent for Repairs!



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"After eighteen months of hard service, the 'Robb' engines are in excellent shape, running very smooth and without a bit of vibration. Up to this time they have not cost one cent for repairs, the only expense being for steam, oil and packing, and this lower than the average. Perfect alignment, parts well machined and good design, make the 'Robb' the most economical and labor-saving engine that has ever come to my notice."

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OF THE HIGHEST GRADE

BUILT FOR HARD SERVICE
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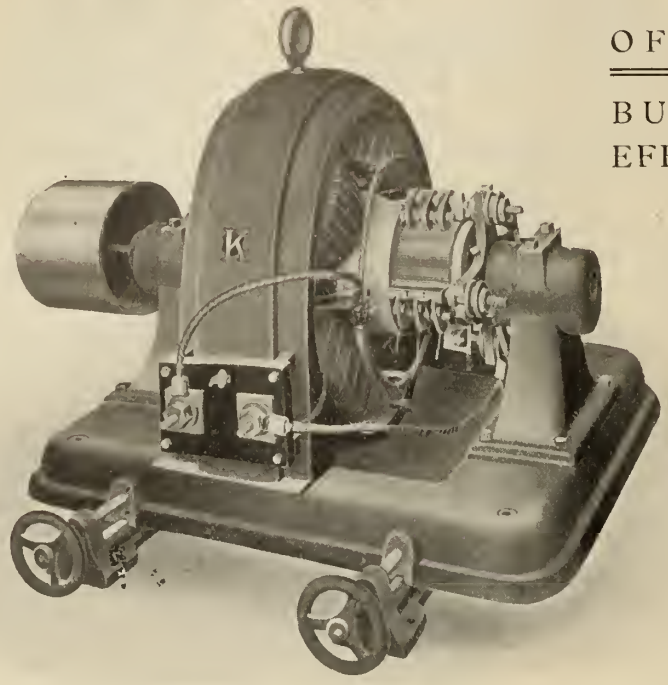

We make them and guarantee them to be as good as we say they are.

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OPEN-TYPE FOUR-POLE DYNAMO OR MOTOR

for belt driving. It is of latest multi-polar design, has coil-wound armatures, is substantial in construction, sparkless running and of the highest efficiency.

Built in sizes from
15 to 60 horse power

We should like to quote you prices

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Head Office, 1170 DUNDAS ST.
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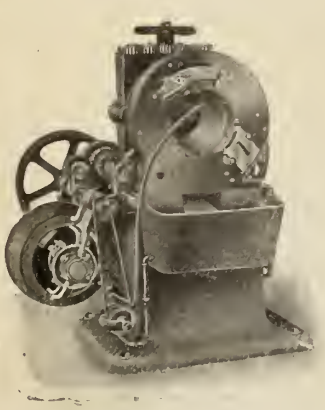
THE CAPACITY FOR WORK

of MERRELL PIPE THREADING AND CUTTING MACHINES—and this combined portable hand and power MERRELL in particular—is unlimited.

Remove the head from the base and use it as a portable hand machine if you wish. It will cut any kind of pipe.



Equipped with our standard quick opening and closing die-heads, improved cutting-off knife and new self-centering vise, this MERRELL will do more work in an easier, quicker and better manner than other machines.

As we make nothing but pipe threading machines we can guarantee each and every part of this machine to do its full share of work and not shirk. That's why we can afford to give it to you FREE for one month's trial.

Isn't this inducement enough?

Will you write to-day?

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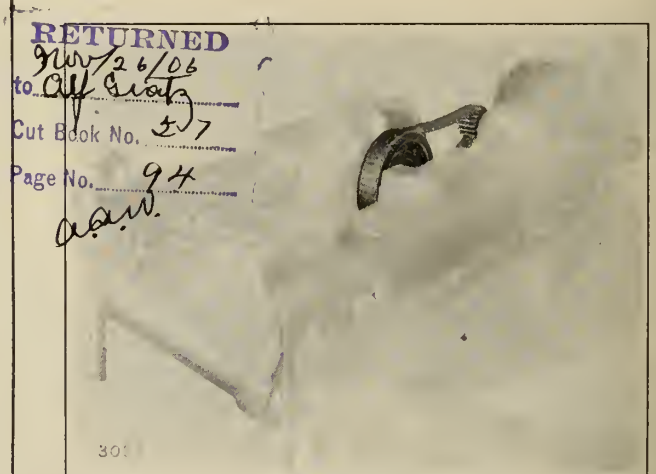

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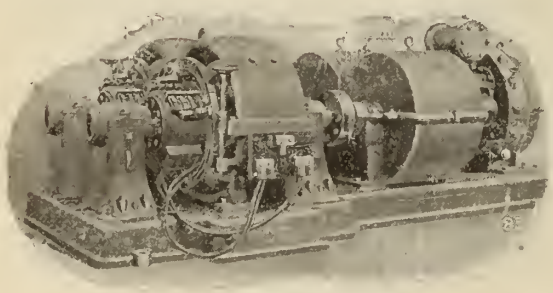

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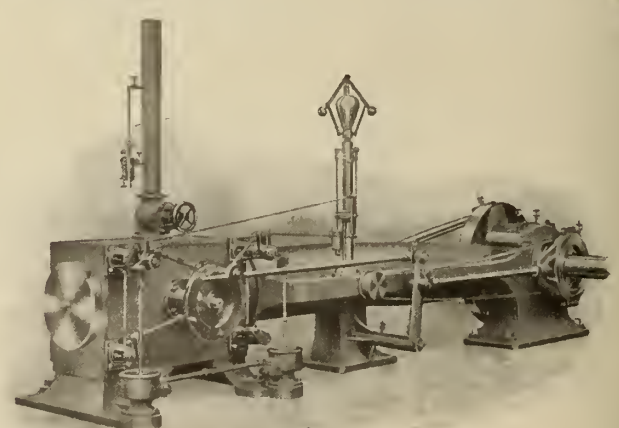

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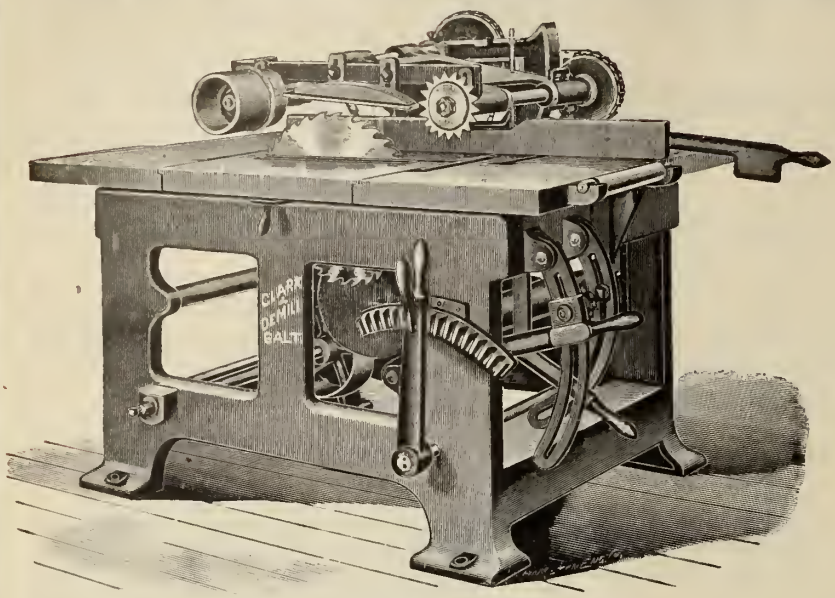

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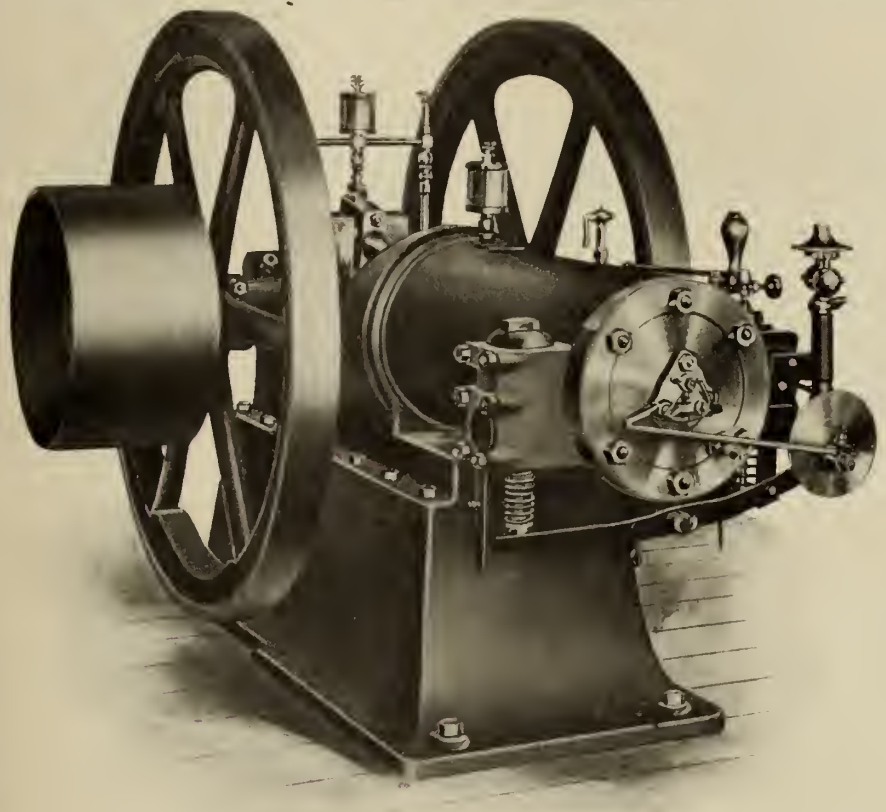

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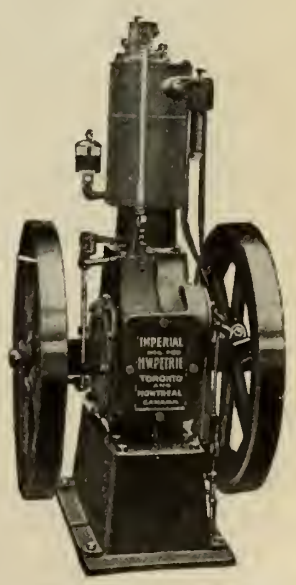
Built in 11 sizes, from 4 to 50 H.P.

Supplied on wheels when required.

The Governor is so constructed that the speed of the engine can be regulated while the engine is in operation.



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Our Vertical is the only engine built with a range of speed from 100 to 600 revolutions per minute, changed while the engine is in motion.

Style E—3 H.P. Height, 3 ft. 9 in. Weight, 550 lbs. Base, 13 in. x 30.
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Your expense bill for fuel ceases immediately you stop your engine, and the fuel consumed is only in proportion to the load on the engine.

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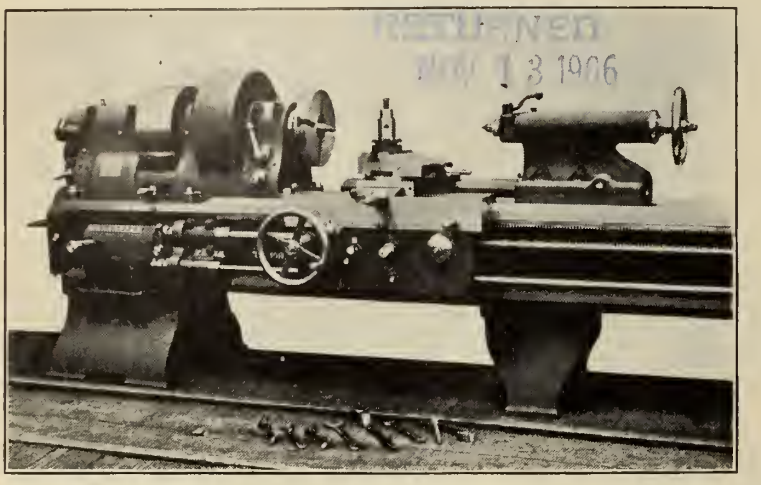

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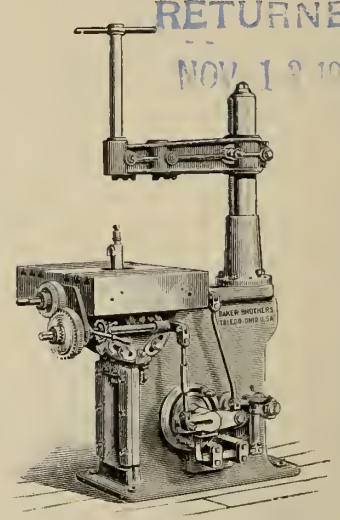

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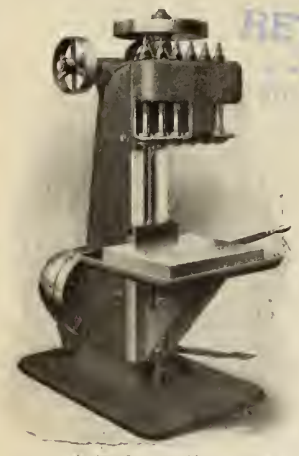

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MONTREAL TORONTO WINNIPEG VANCOUVER

Modern Canadian Manufacturing Plants.

ARTICLE XX.—Indestructible Brick Limited, Toronto.

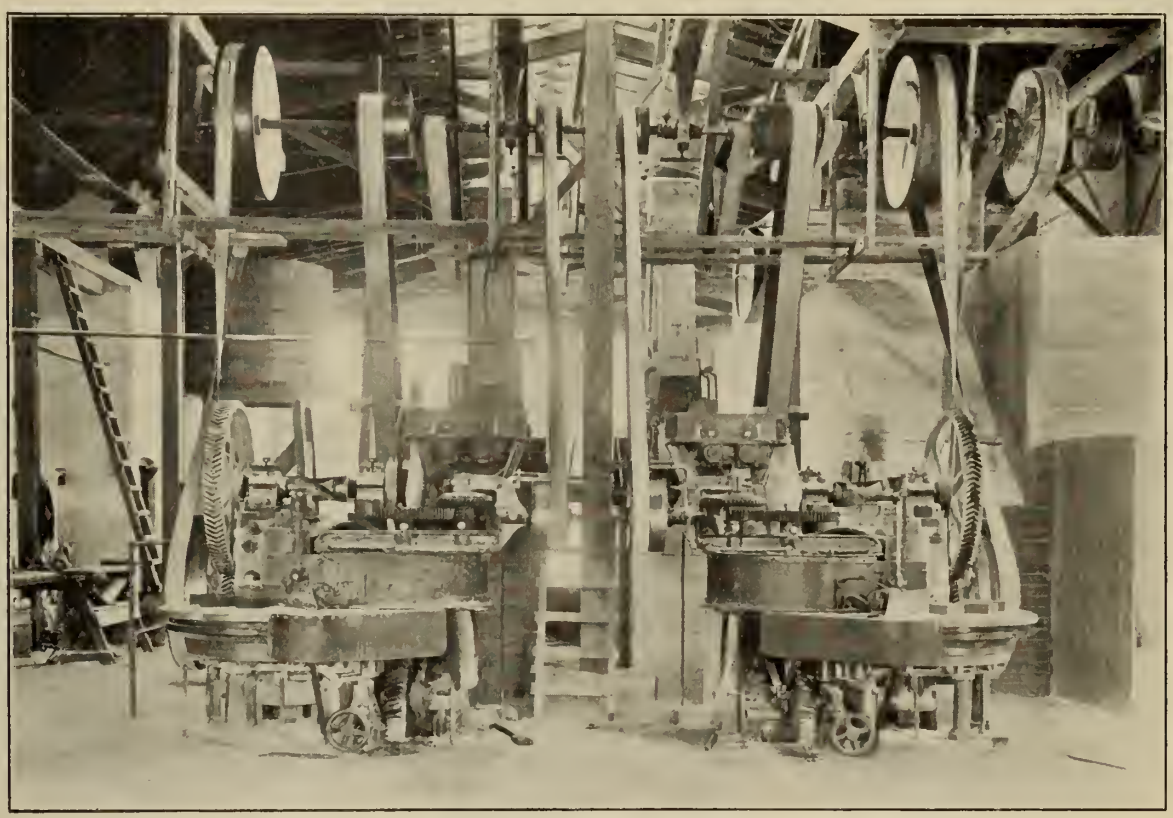
Reviving a Lost Art.

FOR centuries it has been known that artificial stone had been made by the ancients from sand and lime, but the method of accomplishing their purpose in this direction had been considered as lost. The cisterns of Salamo, near Pyrus, and other hydraulic works of that kind consist of this kind of artificial stone. In the ruins of Salamo Temple, near Jerusalem, well preserved remains of artificial sand lime masonry are found, and particularly noticeable are four colossal courses of this masonry in the ruins, which are made of the same material. During the thousands of years that have passed by since these were built, the artificial sand stone has become harder and firmer, while old buildings of burnt brick and harder natural stone have long since succumbed to the influence of weather and have fallen to pieces.

The United States Daily Consular Report of October 3, 1903, gives some information on the subject of making bricks from lime. It is here stated that the first experiments in making bricks from sand and lime appear to have been undertaken at Potsdam over thirty years ago. They were suggested by the fact that Potsdam, like many other places in Central Germany, is surrounded by a wide, sandy plain, which furnishes neither clay for brick nor stone for building purposes. The calcareous bricks were first hardened by exposure to the air, a tedious process which required several months, although the bricks hardened in that way seem to have stood all tests and continue to harden with increasing age.

F. Commick, in Germany, perfected the process of combining sand with hydrated lime and hardening it in steel cylinders under steam pressure. This gave the Germans of this district a cheap building material and one better in every respect than any other for their purpose.

The German Government, always most particular as regards all structural materials, gave sand stone bricks the most exacting test over a period of about five years before they would permit of their general use, and at last placed their stamp of approval on them. Since then the German Government has been one of the chief users of this brick in connection with hydraulic works, dams, military barracks, fortifications, palaces, public buildings and railway stations. In one building erected by the German Government for one of its departments 22,000,000 sandstone brick were used.



Indestructible Brick Limited—Kommick Sandstone Brick Presses. Capacity Each 21,000 Brick Per Day.

Extensive plants were erected in that country, followed by others throughout the continent and in Great Britain. In 1903 the first plants were introduced into the United States and it is only recently that the subject has been taken up with vigor in Canada.

Brick Plant.

On January 9, 1906, Indestructible Brick, Limited, with F. B. Allen, president, W. Del Wilson, vice-president, and Thos. Smith, secretary-treasurer, broke

ground at Swansea for a plant to make sandstone brick. In April the plant was working to a capacity of 21,000 bricks per day. The company's property at Swansea comprises thirty acres of sand, which is probably the best for making sandstone brick of any yet found in Canada.

The demand for these bricks was found to be so great that the company were compelled to add an extra hardening cylinder to their plant. Before operating two months a further addition was made by the installation of another press. In September a further increase of another hardening cylinder was made, which is as the plant stands at present.

Plant of Indestructible Brick Limited, Swansea, Ont.

The handsome brick building as shown in the illustration, made from the company's brick, is 95 by 123 feet and contains a complete outfit for the manufacture of about 50,000 brick a day. The power plant consists of a 100 h.p. Corliss engine, 125 h.p. Inglis boiler, a Moffatt feed water heater and pump. A neat electric lighting plant has also been installed, consisting of a Sturtevant high speed vertical engine, direct connected to generator. Arc lights are used for lighting.

The brick-making machinery consists of four hardening cylinders, each having a capacity of 11,000 brick. A Grand Trunk siding runs to the plant and a complete industrial railway system has been incorporated in the buildings and to the yard. A press is also available for the manufacture of shape brick, enabling the company to keep on hand a complete stock of shape, demanded by architects in all the standard colors.

Chemistry of Sandstone Brick.

The chemistry of sandstone brick is simple. Start with limestone, which is calcium carbonate, burn it in a kiln and burn off carbonic acid, leaving calcium oxide or quick-lime. Mix it with water to slack, which forms calcium hydrate or slacked lime.

The sand and calcium hydrate are mixed and subjected to steam heat and pressure of 120-lbs., which converts the silicic oxide (sand) and calcium hydrate into hydro-calcium-silicate, an entirely separate chemical compound from sandstone or quick lime. This is a chemical union of silico and lime and is a much more indestructible substance than either natural sandstone or limestone.

Making Sandstone Brick.

About twelve hours are required in the making of the sandstone brick. Of this one quarter hour covers the journey of the sand from the ground through the mixer and press, from which it is delivered a finished brick in all except hardness. From the press it goes into the hardening kettle, where it is submitted to a live steam pressure of about 120 lbs. to the square inch continuously for eight to ten hours. At the end of that period an hour is required to cool, that the brick may be handled. They are now complete and ready for the mason, and are hard, strong brick, becoming harder and harder each day for several weeks until their maximum hardness is obtained. In this they resemble natural sandstone, which, as is well known, grows harder with continued exposure to the air. The sandstone may be laid in the wall at once without waiting for its maximum hardness to be obtained. The proportion of sand to lime is about five to one.

The Brick Press.

Aside from the chemical features such as perfect hydration of lime before being pressed into the brick, the most important feature of the sandstone brick industry is the presses and mechanical accessories necessary for the formation of the brick. The apparent simplicity of the operation has lead a great many into the belief that any kind of a press will make sandstone brick. After a course of failures in both Europe and the United States, and some in Canada, it has been learned that only machinery especially designed for the purpose can be made a commercial success. Owing to the difference in nature between dry sand and plastic clay as regards their abrasional qualities, it follows that to withstand the extreme cutting of sand under high pressure specially designed machinery must be used. The press used in this instance is a Kommick rotary sandstone brick press, manufactured by the Kommick System Sandstone Brick Machinery Co., of Toronto, recently incorporated, who own the Kommick patents for Canada.

Indestructible Brick Limited—Steel Steaming Tanks, Capacity Each 14,000 Brick.

Some of the points advanced in favor of sandstone brick are that it improves with age. It has great crushing strength, is low in porosity, has no scaling, but slight heat conductivity, is unaffected by acid, is absolutely sanitary. Further there is no disintegration from extreme climatic changes, and practically no expansion from heat. An economy in laying is effected on account of the uniformity of size, shape, and color, and the faculty with which bricks can be cut. It is claimed to be the only brick with which a two sided finish 9-inch wall can be built.

When starting, this plant some of the bricks were taken to the Toronto School of Science. Here they were tested for crushing strength and showed a resistance of 2,997 lbs. per square inch. City Architect McCallum of Toronto tested the brick to ascertain the suitability for large buildings for Toronto, submitting them to a freezing and fire test. As a result he sanctioned their use for all occasions where bricks are required.

With the Civil Engineers to Victoria.

A Brief Summary of a Three Weeks' Trip, Being the Annual Outing of the Canadian Society of Civil Engineers.

EVERY year the council of the Canadian Society of Civil Engineers plan an educative trip to some point of special engineering interest. This year the usual conservatism of the engineer was set aside in the proposing, planning and successful carrying out of an excursion that for distance, duration of time, and permanent value far exceeded that of any previous occasion. Great credit is due Professor C. H. McLeod, secretary of the society, who, assisted by Dr. J. B. Porter, was responsible for the ideal arrangement of all the many details connected with the trip, the concensus of opinion being that they were complete in every particular. The part the Canadian Pacific Railway played in the outing is greatly to its credit, the officials displaying not only a generous spirit but showing a recognition of the importance of the C.S.C.E. in the development of this great Canada of ours. Free haulage was supplied for a special train consisting of three Pullmans, the "Bathurst," "Trianon" and "Chantilly," and diner, which were at the disposal of the party throughout the trip, except in the lake district of British Columbia. The equipment was superb and the attendance the best possible. Perfect arrangements, perfect weather and, as one of the ladies expressed it, "a perfectly delightful crowd," were features combining to make the outing one of real enjoyment.

John Greey, of W. & J. G. Greey, Toronto Note the Straw Hat, Buffalo Coat and John's Smile.

Prof. C. H. McLeod and Dr. Porter, who Engineered the Trip.

It is possible here to take barely a glance at the experiences of the excursionists, as they hurried across the prairies, at that time yielding their millions of bushels of grain, or as they followed the winding steel trail through the matchless Rockies or sailed across to the beautiful Victoria, or at one time climbed mountain peaks into the very clouds and at another descended hundreds of feet into the earth. Imagination could not picture a wider variation of scene or situation. Whether on board the train admiring the glorious scenery or visiting some feature of engineering interest, or being entertained by an appreciative municipality or company the civil engineers and friends were enjoying the trip with intense delight.

On Sept. 8th a special train pulled out from Windsor street station, Montreal, being joined at North Bay the same evening by a Pullman from Toronto and Western Ontario coterie. The personnel of the party was made up of:—

Prof. Owens in Hunting Attire at Calgary. Next day many a Black Duck was Missed from his Usual Haunts.

C. H. McLeod, Professor of Applied Science, McGill University (Secretary C. S. C. E.); Dr. J. B. Porter, Professor of Mining, McGill University; A. Amos; J. Duchastel de Montrouge; W. A. Murray; C. de B. Leprohon, Assistant City Engineer; R. B. Owens, Professor of Electrical Engineering, McGill; R. F. and Mrs. Ogilvie; L. G. Papineau, Engineer Public Works' Department; S. F. Rutherford; F. P. Shearwood; W. J. and Mrs. Sproule;

Miss McLeod ; Miss Bray ; Miss Smith, of Montreal.

W. A. Bucke, L. Cousins, S. Groves, Editor "The Canadian Engineer;" J. G. Greey, of W. & J. G. Greey Co.; Lieut. Col. Chas. S. Jones; F. S. Keith, Editor "Canadian Machinery;" H. McLeod, Supt. of Const. C. G. E. Co.; C. B. Smith, Chairman T. & N. O. R. Commission ; F. and Mrs. Simpson,; A. P. Walker, Assistant Divisional Engineer C. P. R.; Mrs. N. M. McLeod; Mrs. Walker ; Mrs. C. B. Smith ; Mrs. Coon of Toronto.

J. T. Bertrand, Outside Construction Engineer, Dominion Public Works' Department ; Capt. R. DeCorriveau, Public Works' Department ; F. A. Drought; Arthur Surveyor, Engineer Ship Canal, Georgian Bay ; James White, Dominion Geographer ; Mrs. Papineau ; Mrs. White ; the Misses Wukstead, Ottawa. W. D. Baillairge, City Engineer, Quebec. Col. H. N. and Mrs. Ruttan. Chicago, Ill., U.S.A.—Octave Chanute ; Miss Chanute ; Mrs. Boyd. C. W. Archibald, Chief Engineer Intercolonial Railway, Moncton, N.B. T. C. McConkey, Guelph, Ont. Geo. H. Frost, President Engineering News Publishing Company; Van Winkle, Consulting Engineer, Patent Attorney, New York. H. J. Haffner, Irrigation Engineer, Calgary, Alta. Major T. Harry Jones, City Engineer ; Mr. Sweet, LL. B., barrister ; Mrs. T. H. Jones ; Mrs. Sweet, Brantford, Ont. Wm. Kennedy, Jr., Owen Sound, Ont. Capt. Bethune Lindsay, Royal Canadian Engineers, Halifax, N.S. S. G. and Mrs. Laviolette, St. Jerome. Chas H. Mitchell, Hydro-Electric Engineer, Niagara Falls. T. A. McLean, Mining Engineer, Frank, Alta. F. F. Miller, Master Miller and Mrs. Miller, Napanee, Ont. Geo. D. McKinnon, Assist. Manager Jenckes Machine Co., Sherbrooke, Que. Geo. Ross ; Mrs. Ross ; Miss Ross, Welland, Ont. Dr. E. Seaborn, London, Ont. Miss Paverley ; Miss Edith Paverley, Searboro, Eng. James Kennedy, Resident Engineer, Vancouver, B.C.

At Winnipeg the first stop was made on Monday, Sept. 10th, where the party were guests to luncheon of Mayor Sharp and Aldermen at Silver Heights, being of the nature of a civic entertainment. In the evening a garden party was given by Col. and Mrs. Ruttan at their home in honor of the guests. At Calgary a visit was made to the Irrigation Works, where one of the most extensive irrigation projects on the continent is under way. Chief Engineer Dennis provided a luncheon at the engineer's camp which was heartily enjoyed after the long drive. The journey was continued the same afternoon, continuing through the foot hills into the

One of the Many Spots where the Familar Remark "O, O, Look at the Scenery" was heard.

Bonnington Falls, 80 Foot Head, on Kootenay River 10 Miles from Nelson, B.C., where Large Electrical Development is Under Way.

On C.P.R. Steamer, Rossland, Coming Down the Arrow Lakes.

View in Granby Mine, Phœnix, B.C., showing Method of Mining this Mountain of Solid Ore.

mountains stopping at Banff at 7 p.m. Until 3 p.m. the next afternoon the wonders and beauties of this marvellous district was enjoyed. Laggan from which Lake Louise is reached was the next stop, followed in turn by several hours at Glacier where the entire party climbed to the field of perpetual ice. Exactly a week from leaving Windsor station, Montreal the special train drew into Vancouver. Here after visits had been made the plant of the Pacific Coast Pipe Co., where wood stave pipe is manufactured and to some of the large saw mills, a trip was made by special steamer to the power plant of of the Vancouver Power Co., where an economical and highly up-to-date insallation supplies electric energy for Vancouver. This was followed by a trip to Victoria where a committee showed the party the beauties of the place, by means of both carriages and motor boats. From Victoria trips were made by some of the party to Nanaimo and Esquimalt. Leaving Vancouver on Tuesday, Sept. 18th, an addition to the party was made at Revelstoke when Mr. C. B. Smith, in his private car Wanaganni, and ladies joined the party.

The Lake Trip.

At Arrowhead the special train was left behind and the entire party embarked on the steamer Rossland for a sail down the Arrow Lakes. From West Robson the party journeyed by train to Nelson. Here a launch party including a visit to a fruit ranch showing some of the wonderful possibilities of this district, followed by a visit to Nelson Fair were features. At Bonnington Falls the new power house of the West Kootenay Power & Light Co. was visited, and a luncheon given by the officers of the West Kootenay Power & Light Co. enjoyed.

Mining Country.

To go into detail as to the many interesting features of the mining country would take many pages. At Rossland the LeRoi, Centre Star and War Eagle mines were inspected by different divisions of the party. From an engineering view point, for its size Trail offered as much of interest as any other place. Here the plant of the Consolidated Mining & Smelting Co., of Canada, is situated. Besides smelting the copper ore from various mines around lead ore is smelted and the pure lead deposited by the Betts process, electrolitically, and from the slag pure gold anatomy and silver are recovered. A different style of mining to that carried on at Rossland was seen at the wonderful Granby mine at Phoenix, where 2800 tons of ore from a solid mountain of this material are obtained every day. At Greenwood further mining and smelting experiences were obtained. The mine operators and citizens were lavish in their entertainment which ended with a high class banquet.

When in this district Grand Forks was headquarters for two days, and before leaving the Granby smelter was gone through, and the method of smelting the copper ore contrasted with that of Trail and Greenwood. It is impossible in a few sentences to do justice to the wonders of this British Columbia mining country as seen by the civil engineers.

Returning Home.

Returning to Nelson the return trip was commenced by boat through the Kootenay Lake where the special train having gone around by Calgary was waiting to carry the crowd on the eastern journey. A number of stops were made in the Crows Nest Pass district and at Michel an opportunity was given of going into one of the extensive coal mines. A couple of hours were spent at Frank viewing the scene of desolation ocassioned by the landslide of two years ago. A few stops were made from the Rockies to Winnipeg where it was proposed to spend an afternoon and evening but owing to the lateness of the train the afternoon trip was impossible.

As a lively finish to a strenuous trip the engineers of Fort William and Port Arthur combined to entertain the party which was done in a royal manner. On the afternoon of Sept. 27th, a large tug was chartered by means of which a splendid opportunity was given of viewing the elevators and coal and ore loading facilities to be found there. In the evening a reception was given at the City Hall where nearly all the party young and old alike danced the hours away until close to the time for departure. At North Bay the Toronto car and Mr. Smith's were detached, the major portion of the excursionists arriving in Montreal on Saturday, the others going to Toronto and on to their various homes.

As mentioned in starting it has been possible to merely mention the events of the trip giving no detail whatever but it is hoped in later issues to give some accounts of various manufacturing and engineering features encountered on the way.

THE USE OF CLAY CONES IN STEEL HEATING.

THE days of estimating the heat of a work-piece by the color have gone by — at least in establishments were any weight is laid on uniformity of product. In the first place, no two men will agree as to the color of a piece in any one fire or bath; and in the second, the same temperature will be differently estimated in different parts of the shop or at different times of the year—or even day; and in the third place (what is of equal importance), no two steels will show the same color for the same temperature. Something more exact must take the place of the eye. There are some good pyrometers, but they are generally expensive and delicate, and inconvenient to apply. But there is a means of measuring—not estimating—temperature, which manufacturers of fine porcelain use, which should be of great value to steel workers in enabling them to ascertain with certainty just what the temperature in a furnace really is, instead of guessing at it. And here we may add what we should have given as fourthly above—that the eye grows tired and less sensitive to color; so that the same temperature will be estimated lower, after ten minutes' watching red or white hot metal or combustible.

The method to which we refer consists in the use of porcelain—or rather clay—cones of various melting or softening points; there are about sixty different grades, each stamped with a number corresponding to a definite temperature at which slumping down takes place. The range of temperature is between 590 degrees and 1,940 degrees C., or say 1,094 to 3,524 degrees F.

In order to find out which cones to use, where the right temperature is not known in degrees, the first test is made with several cones, and that one is chosen as the standard which at the desired temperature curls over and nearly or quite touches the floor of the furnace. It is best to use two cones of the proper number, one for the hottest and the other for the coolest part of the furnace; their curling over is to be watched through the usual peep-holes, preferably covered with mica. The cones should be protected from direct flame, just as much as the work-pieces are. A good way is to fence them around with two bricks on the side and one on top, the cone also standing on a brick. Another way is to use open-sided clayware hoods provided for the purpose, and which melt at a higher point than any of the cones. There are also small muffles which serve the same purpose, as well as capsules with lids; these latter, of course, must be drawn from the furnace in order to observe the cones.—Scientific American.

CANADIAN MACHINERY
and Manufacturing News

A monthly newspaper devoted to machinery and manufacturing interests-mechanical and electrical trades, technical progress, construction and improvement, and to all users of power developed from steam, gas, electricity, compressed air and water in Canada.

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Modern Canadian Manufacturing Plants - - - 409
Indestructible Brick Ltd., Toronto.
With the Civil Engineers to Victoria - - - - 411
Editorial - - - - - - - - - - 414
Ontario's Metal Features
Some Municipalities Opportunity.
Motor Parts Wanted.
New Machinery Hall Assured.
Machine Shop Economies.
New Field for Gas Engines.
Tricks of the Trade - - - - - - - - 416
Combination Foundry Ladle - - - - - 417
Practical Questions and Answers - - - - - 419
Personal Mention - - - - - - - - 420
Mechanical Reviews - - - - - - - - 421
Installing a Storage Battery and Booster.
Problems in Gearing.
Projection of Wood Shaper Cutters.
Max. Development of Steam Engine.
Cutting Lathe Lead Screws.
How to Forge a Good Wrench.
Electric Motor in Wood-working Plants - - - 424
By T. C. Robertson.
The Development of Steam Turbines - - - - 425
By Dr. A. Riedles.
Book Reviews - - - - - - - - - 427
Power and Transmission - - - - - - - 428
Test of Pumping Plant
The Free Rotary Engine.
Large Generators.
Beginning of Heating and Ventilating.
New Buckeye Engine.
Motors for Rolling Mills.
Conditions of Fan Blower Design.
20-inch Iron Groved Wheel.
Machinery Development - - - - - - - 433
New Automatic Rack Cutter.
Brown and Sharpe Milling Machines.
New Horizontal Drill.
Capstan Cable Jack.
About Catalogues - - - - - - - - 437
Industrial Progress - - - - - - - - 438
Companies Incorporated - - - - - - 444

OCTOBER'S METAL FEATURES.

CONSUMERS of almost every kind of commercial metals are finding an increasing difficulty in obtaining supplies, and prices are in many cases higher than the oldest metal men have ever known them before. The month of October has been remarkable for the all around strength shown on the metal markets, and from all appearances the end of the boom has not yet come.

Sensational advances have been made by lead and copper. At the end of September lead began to make gradual strides upward on foreign markets. For some time Canadian prices did not follow suit, but the situation was so firm that prophesies of 5-cent lead were freely made. These predictions would have seemed ridiculous a few months ago, but the fact remains that the price of lead to-day is well above the five-cent mark. There have been temporary breaks from this figure within the past week or so, but it seems reasonably certain that the short supply of and brisk demand for the metal will keep prices almost stationary for some time to come. At time of writing quotations are the highest on record.

For many years copper has not been so high as it is to-day. That a scarcity existed has been known for a considerable time, but the producing interests seemed anxious that prices should be maintained on a reasonable level, so that deliveries were carefully distributed and the advance delayed. The inevitable has happened, however, and prices are soaring higher almost every day in both sheets and ingots.

Founders and other users of pig iron have had many disappointments during October. A scarcity has developed all over the world, and furnaces everywhere have booked their output for months ahead. Canadian importers have felt the effects of the stringency, and have been assailed with telegraph and letter requests to ship immediately. Several well known brands were absolutely off the Montreal market some weeks ago, and it is stated that even those consumers who have hitherto stuck religiously to their favorite brands will undoubtedly have to accept mixtures during the coming Winter. The Canadian steel companies are themselves taking practically the whole output of their furnaces, and the independent producers have been hard pressed to supply orders. It is understood that the Deseronto Iron Co. have recently given up the manufacture of charcoal iron.

Sheet metals as a whole are quite as firm as ingots, and during the month advances have been made in sheet lead, copper and zinc, while importers generally raised galvanized sheets at the beginning of the month. Black sheets are also higher in some gauges. If the present situation continues much longer, finished materials will have to advance materially to permit of a profit in the manufacture.

SOME MUNICIPALITIES OPPORTUNITY.

A LARGE manufacturing firm in the United States who have been making high-grade metal-working machinery for the past forty years, are desirous of opening and operating a plant in Canada. They inform us that if any municipality has a suitable manufacturing plant in the right location, with a foundry attached, or if any town has a good building for manufacturing and a foundry already established, they would take the matter up at once and come to a decision very quickly.

This is a desirable proposition for some municipality. Any manufacturer or board of trade interested will be put in direct communication with the firm in question by letting us know in detail what they have to offer.

MOTOR PARTS WANTED.

EVIDENTLY the manufacturers of motor parts in France are unable to supply the demand and are looking to Canada for help to enable them to fill their orders. The following letter from the British Chamber of Commerce at Paris, to the editor of Canadian Machinery, explains the situation there :

Dear Sir,—Please accept my thanks for copy of your excellent journal, which, I feel sure, will interest importers here. I have already, in fact, an inquiry from one of the members of our chamber, who desires to know whether any Canadian manufacturers of motor car parts are open to do export trade to France. If you can put this inquiry in the way of any of your advertisers so that they may communicate with this office, I shall be much obliged.

Thanking you in anticipation,

Yours faithfully,

(Signed), J. B. MEADOW-SMITH,

Secretary.

Enquiries sent to the different automobile manufacturers in this country have brought out the fact that there is no possibility of the wants of French manufacturers being supplied in Canada in the immediate future. Only one firm in this country make these parts and it is hardly able to supply the demands of the firm's output without seeking foreign trade. This seems to offer a good avenue for an enterprising manufacturer in this country.

NEW MACHINERY HALL ASSURED.

CONSIDERABLE interest was evinced in the opinions of various manufacturers and of the decided stand taken by Canadian Machinery in our September and October numbers on the question of a new Machinery Hall for the Canadian National Exhibition. Opinions expressed were unanimous in favor of a new building to properly exhibit the high-class machinery manufactured in this country. The need was a crying one as the consensus of opinion has indicated. Manufacturers may now take a more cheerful view regarding the future in this connection, as we have been assured by Dr. Orr, manager of the Exhibition, that a new Machinery Hall is proposed for the near future.

In his official report not yet published, Dr. Orr has urged upon the authorities to take steps in this direction, quoting the opinion of Canadian Machinery and of our friends who have favored us with their idea in the matter. When the new land east of the present grounds has been secured it is proposed to move the stables to the easterly portion of the grounds, leaving a large area available for a Machinery Hall along modern lines. It will be necessary to have it adjoining a railway track that a siding may be run directly into the building. This, with traveling cranes, will give manufacturers a chance to unload their machinery and place it on the space allotted at a minimum cost and with minimum wear and tear on the various parts. The matter will, however, have to go through the hands of the city council, and even if it is decided at the earliest possible moment to go ahead with this building it would be impossible to have it for the coming Exhibition, but it is fully hoped and expected that the succeeding one will find a new Machinery Hall equipped and ready and of ample size to fulfill all requirements. This is a matter of sincere congratulation on the part of the various manufacturers of metal, wood-working and other machinery and power plants. It means that they can only exhibit their high-class product to advantage but also as is the case in the Process Building, they can show an admiring public the various processes carried on by the different machines manufactured.

In view of the disastrous and unfortunate burning of several of the Exhibition buildings on the night of October 18, the immediate prospect of a new Machinery Hall has received somewhat of a setback. We are assured by Dr. Orr, however, that the original intention is to be maintained, and as soon as the burned buildings have been replaced, and proper provision to meet its construction, the new Machinery Hall will be a reality.

MACHINE SHOP ECONOMICS.

REPAIR machine shops cannot be classed, as far as economy goes, with the shop of a manufacturing plant. The reasons are many. The entire work of a manufacturing shop can be arranged with more or less precision. For the most part each tool can be devoted to a certain class of work, and thus the work can be all pre-arranged. In the equipping of the manufacturing shop one has a more or less accurate knowledge of the tool requirements, and with good management no unnecessary tools need be installed. Practically speaking, if the plant is running under full capacity no tool need be standing idle, and each can have work for which it is best adapted. This cannot be done in a repair shop. There the work is intermittent and varied, and the shop must be equipped for emergency cases as well as for ordinary work. In a repair shop there will be at one time a rush of work, whereas at another time things will be very slack ; and in consequence there will be times when some of the mechanics will have very little work to do. As a result of these conditions the mechanics will often times regulate their working speed to suit the amount of work before them, working slowly when there is very little ahead and working quickly when there is a rush. Thus there is necessarily a slackness with regard to the methods of work regulation in these shops, and there is in consequence a tendency to conduct things generally on slack principles. This should be guarded against. In shops of this kind economy in power is very often lost sight of, because in other things economy is not a consideration. In a repair shop economy in power can as well be considered as in a manufacturing shop, and because economy cannot be practiced generally it should be given special consideration where possible. Economy in power is a factor to which it would pay the superintendent of a repair shop to give special consideration.

NEW FIELD FOR GAS ENGINES.

NOW that the success of the gas engine is assured for automobiles, motor boats and manufacturing, another field is being exploited which, if successful, opens a wider sphere of usefulness for internal combustion engines, being its adaptation to self-propelled cars for suburban traffic. The cars now under test by different companies are run by motors and electrically controlled as has heretofore been the case, being as it were a power house on wheels, the initial power being supplied by gasoline engines. No figures as to the relative economy of this method are yet available. Should they near approach what has been prophesied for them they are bound to become a factor for suburban and interurban traffic for both freight and passenger service.

Tricks of the Trade

Everybody is invited to contribute to this page. Send in your ideas, odd jobs you are doing, and anything of interest to fellow-workmen. Remuneration will be made for such contributions. [Ed.]

SAVING OIL IN THE ENGINE ROOM.

"TIME is money," because time has a money equivalent, and by the same rule oil is money, because it also has a money equivalent or cash value. Now a perfectly logical deduction would be: that to save oil is to save money, and because the saving of money is a live topic I am going to say something about saving its equivalent—oil.

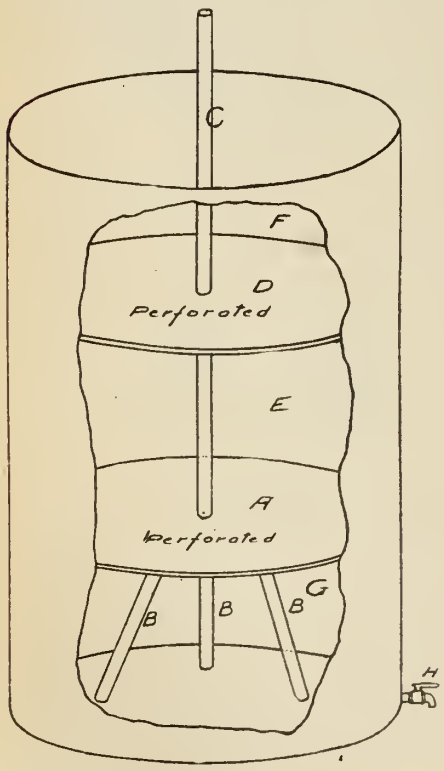


Fig. 3

The great majority of the readers of Canadian Machinery are sure to be engine owners, therefore I am encouraged to hope that this little article may be read with at least some interest by some one.

The power engine in the plant of which I have charge is a 14x36 Corliss

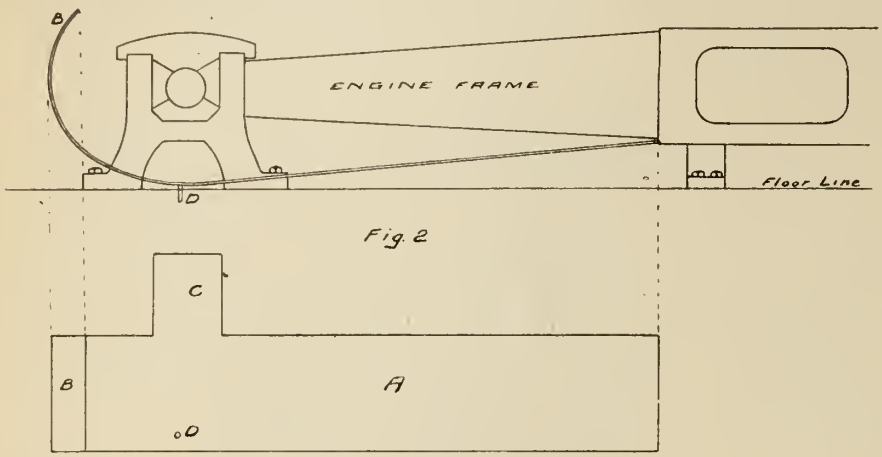


Fig. 2

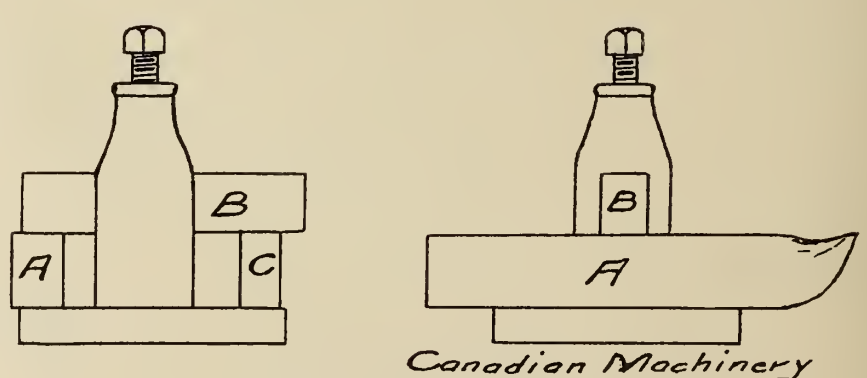
Fig. 1

of the girder-frame pattern (the pattern most common in Canada). For a long time, like nearly all the other engines of her pattern, she flung her oil on the floor, up against the wall, or any old place that seemed to suit her (I was going to say taste, but tastelessness would be more truthful) till one day the idea got into my head that I could harness Niagara—I mean the oil shower. Fig. 1 shows the idea as I had it reproduced in galvanized iron, and Fig. 2 shows it as applied to the engine. The dotted lines connect the same part in the two figures. Fig. 1 is a large oil pan ½ in. deep and made something like a toboggan with a projection on the side of it. (A) is the main body and runs from the outer end of the lower guide, slanting down to the floor at the main bearing. (B) is the end curved upwards to a circle somewhat larger than the sweep of the crank, and (c) is a projection of the pan that extends through underneath the arch of the main bearing and out far enough to catch the drip from the eccentric. By this arrangement I catch all the oil from both guides, the cross-head pin, the crank pin, the main bearing and the eccentric. Now that very nearly includes the whole engine. The oil all runs to the lowest spot in the pan, which is at the hole (D), and then passes down the pipe (D) into a pail that I keep hung underneath the floor and to which I have access by a small trap-door, which I had cut for the purpose.

Now in this oil there is bound to be more or less dirt, so to make it fit for use I rigged up the simple filter shown in Fig. 3. It consists of a 5 gallon can with the top cut off, into which I fitted the wooden piston (A), with three legs on it, (BBB), making a sort of three-legged stool. This piston or disc I bored full of holes, and into the central hole I screwed the pipe (C). Then I made a second piston (D), same as (A), only without legs, and with the central pole made large enough to allow it to slide up and down on the pipe (C).

The space (E) I then packed neatly, about 6 in. deep, with cotton waste. I pour the oil into the space (F) and it filters through the waste into the space (G), from which I draw it by the tap (H). The use of the pipe (C) is to let the air out of the space (G) as the oil comes in, and to let air into the space (G) when oil is drawn off.

If it were necessary I would—and have—used this filtered oil a second time on my engine, but having a lot of shafting to oil out in the shop I pass it on to the oilers and save just that much new oil. The result is that I oil my engine for practically nothing.—R. Manly Orr.



Substitute for Off Set Cutting Off Tool.

SUBSTITUTE FOR OFF-SET TOOL.

A GOOD substitute for an off-set cutting off tool, for threading up close to chuck, is by using a straight tool clamped on tool post washer by means of a square steel bar as square as tool post slot is wide. I think sketch will explain. (A) is tool, (B) is bar through slot, (C) is block. I have found it very handy for cutting off even with chuck jaws.—Jas. Moore.

RESTORING PERISHED RUBBER.

RUBBER is used by the machinist mostly for solid springs, for washers and derigable pipes. For such purposes elasticity is the main essential. But rubber in its various manufactured states looses its elastic properties by age and exposure. This "perished" rubber can be at least partly restored by soaking in "ammonia fortor." And by the same expedient the perishing of old rubber goods can be long delayed.

The chemistry of the action is not very clear in its detail, but it is probably in the nature of a deoxidizing agent for the rubber, and also a regenerator for the carbonates so largely used as "fillers." It is a fact that manufactured rubber is a "mysterious" produet—in its was as deceitful as soap." Rubber itself is of different kinds derived from several different trees and vines. Besides these inferior grades various gums, also products derived from boiled oil and its homologues are used as adulterants, and liberal fillers of tale, chalk and the like are added. All pure rubber is very susceptable to sulphur, promptly going to a stieky mess. It is in this way that the evil smelling bi-sulphide of carbon acts to make rubber cements, but a common sulphur match will, if left in contact with a rubber band, get there just the same, and with less advertisement by smell.

Although rubber is used so extensively for washers, it is but a very poor substitute for leather, for under pressnre rubber flows as ice does, only much more readily, and also the mechanical mixture of the powder used as filler washes out.—C. J. Stuart.

SOLDERING ALUMINUM.

THE most satisfactory alloy for soldering aluminum consists of 1 part aluminum, 1 part phosphor tin, 11 parts zinc, and 29 parts of tin. To avoid loss of the more easily volatile of these metals the aluminum is melted first, then the zinc in small pieces, and the tin in small pieces, and lastly the phosphor tin. For soldering no acid is used, but the surfaces to be joined are fresh scraped and covered with a thin coat of the solder in the usual way, then brought together and sweated with the soldering copper, a blow pipe or a torch, while pressure is applied as the solder softens to make the joint.

The aluminum must be heated to about 660 deg. F. before it can be soldered.—From Iron Age.

This method is considered satisfactory for making Aluminum patterns in more or less constant use. For instrument work it is usual to nickel-plate the parts to be joined, and use silver solder, which makes a job as nearly lasting as can be.

The usual trouble with aluminum soldering schemes is two-fold. A thin glace of oxide of aluminum forms readily on exposed surfaces of the metal, and is difficult to remove with a flux, and is not affected by most acids in cleaning, hence the resort to fresh scrapped surfaces. Second, when the solders are in place and holding, the several layers of aluminum and alloys of zinc, and zinc and tin, readily forms an electric couple, especially with changes of temperature, as one consequent of the currents resulting we have electrolysis of the alloys, with the inevitable weakening at the joint. The nickel plating resists and protects the silver alloy, while the presence of phosphorus even in a small percentage tends to check the formation of an electric couple.—C. J. Stuart.

Combination Foundry Ladle

By John D. Adams

THE accompanying drawings illustrate a very convenient form of Foundry Ladle of 2-ton capacity. The design is such that the ladle can be used as an ordinary guard crane ladle or placed in its truck and used on a suitable track system about the foundry. The ladle is held in position on the truck by means of two pins $1\frac{1}{4}$ inches diameter by 4 inches long, welded on the lower ends of the vertical bars which support the ladle. These two pins fit into holes drilled in the top of the vertical standards of the truck. Arranged in this manner, the ladle can be run up on the track in front of the cupola and filled; after which it may be lifted from its supporting standards by a travelling or jib crane and poured by means of the worm gearing attached thereto. If the Cupola is within reaching distance of the crane, the ladle may be swung by the crane onto a pair of vertical stationary standards in front of the cupola and used as a "Catch" Ladle.

Truck.

It is hardly necessary to give any description of these standards or of the truck as local conditions, such as gauge of track, etc., will govern the design. In fig. 2 the standards are gray iron castings of angle section, which are bolted to the sides of the truck which are also of cast iron. If there are no sharp turns in the track system and a long wheel hose can be used, it will be possible to set the ladle lower, because the axles can then be placed outside of the standards as shown in Fig 1.

Ladle Gearing.

The ladle proper is provided with the worm and worm wheel form of gearing, which is the most commonly used form of gearing for crane ladles of moderate capacity. Pouring is controlled by a hand wheel shown on the right hand side. This operates a pair of bevel gears having a ratio 2 to 1, which in turn operate the worm and worm wheel, which is keyed directly on to one of the trunions of the ladle. For one quarter turn of the ladle on its trunions, eighteen turns of the hand wheel are necessary.

The number and size of the teeth in the gearing are as follows:—Bevels 12 and 21 teeth, $\frac{3}{4}$ inch circular pitch; worm wheel 36 teeth, $1\frac{1}{4}$ inch pitch; worm single thread $1\frac{1}{4}$ inch pitch; pitch diameter of bevels, 5.73 and 2.86 inches; pitch diameter of worm wheel 11.32, and minimum outside diameter, 15.12 inches; pitch diameter of worm, 3.58 inches; outside diameter, $4\frac{3}{8}$ inches; total depth of teeth, .858 inch; width of space at bottom of worm teeth, .387 inch; angle of worm teeth, 29 deg. In this ladle all gearing had ordinary cast teeth and was all fitted up

complete before attaching to the vertical support of the ladle.

Bowl.

The bowl was designed to carry 4000 pounds after allowing 1½ inches for lining on the sides, 2 inches on the bottom and 3 inches on top for slop. The dimensions of the bowl taken inside are as follows:—Diameter at top, 31½ inches; diameter at bottom, 28½ inches; depth 30 inches. Two plates of ¼ inch tank steel, 32 x 53 inches, were used to cut the two side pieces from and a circular disc 5-16x32½ inches was used to flange the bottom from. Side seams are lapped and single inverted with ⅝ inch rivets 2½ inch centres. Care should be taken to countersink the rivets below the centre line, so as to permit of the hand with its trunions being slid on to the bowl. The girth seam is single inverted with ⅝ inch rivets, 1¾ inch vent holes in the bottom before riveting up the bowl.

Forgings.

A bar of iron 4x¾ inch should be bent on edge to the extent of about 6 inches, so that when it is rolled to the diameter of the bowl, it will conform to its taper. After the band is welded into a continuous ring, the trunions are forged on. These should be of 2½ inch round iron, which is afterwards turned to 2 5-16 inches. The uprights are of 3x¾ inch iron, which should be welded to 3x1 inch iron for the bearings of the trunions, to allow for forging and boxing out. The ends of the trunions should be boxed with a one inch drill for several inches to receive the steadying bars. Dimensions of loop and cross bars are as shown in Fig. 1.

To counterbalance the weight of the gearing, the ladle should be provided with a cast iron weight swung on the opposite trunnion. The weight of the ladle proper complete is about 1075 pounds.

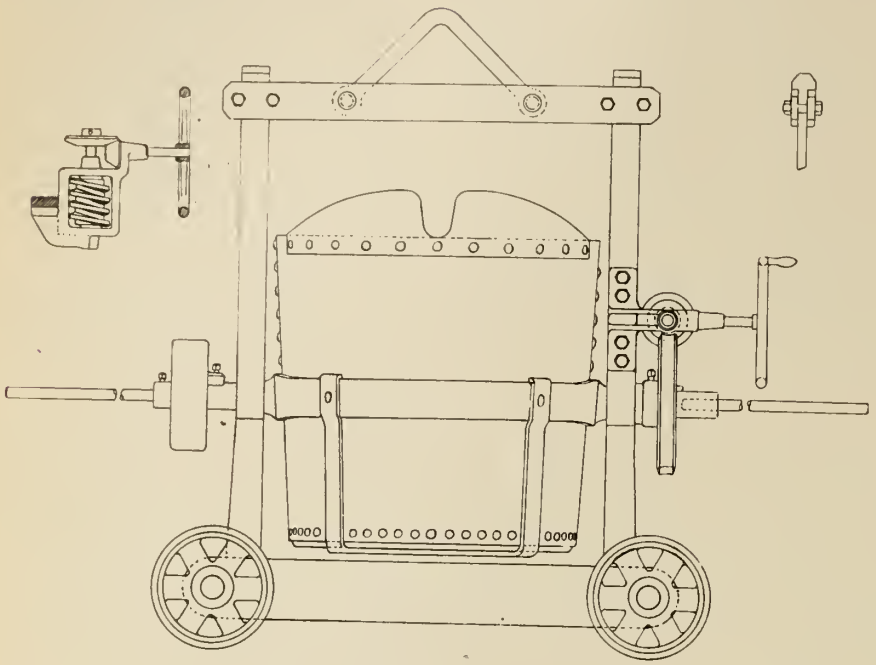


FIG. 1.

FRICTION AND LUBRICATION.

SOME interesting and valuable experiments, conducted some years ago by R. Tower for a research committee of the Institution of Mechanical Engineers, of Great Britain, but which have not been widely published, are described here by Professor G. F. Charnock. The work was carried out with a belt-driven shaft of steel, provided with a journal four inches in diameter and six inches long. Upon the upper side of the journal was fitted a gun-metal step, the arc of contact being rather less than half the circumference. Various means of lubrication were provided, the last being a bath of oil. The results of the experiments were that the friction is nearly constant under all loads, within ordinary limits, and it does not increase in direct proportion to the load, according to the ordinary laws of friction. The coefficient of friction with bath lubrication varies inversely as the pressure; or, in other words, the friction of the bearing is altogether independent of the pressure upon it. This is provided the pressure does not exceed 400 to 600 pounds per square inch. The coefficient of friction is inversely proportional to the temperature. The friction increases with the velocity apparently nearly as the 1.5 power. The coefficient of friction varies with the lubrication used, and was found by Tower to be least for olive oil and lard oil. Sperm oil comes next, followed by mineral oil and mineral grease.—Mechanical Engineer.

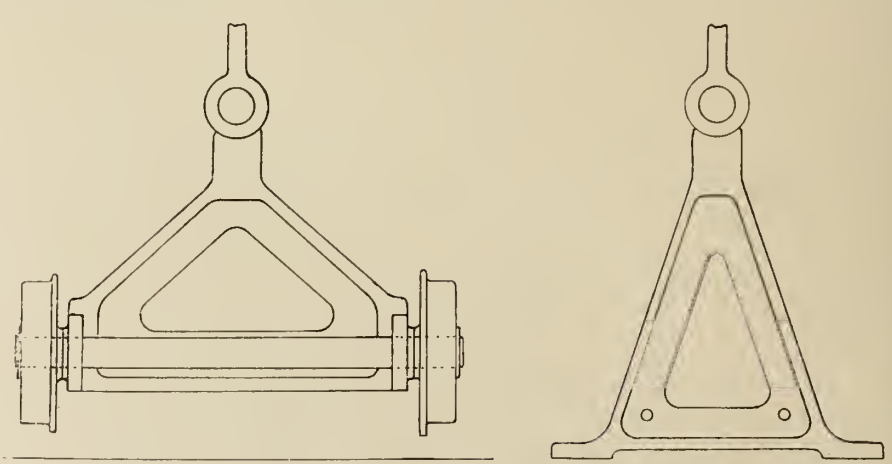


FIG. 2.

The manufacture of tantalum, one of the hardest metals known, into sheets and bars is now, it is said, being practised in Germany by the squirting process, the material in its original powdered form being mixed with water and gum tragacanth, and then successfully forced into rods and shapes as desired.

Never whip your brain. All high pressure is dangerous. Study to think as quietly and as easily as you breathe. Never force yourself to learn what you have no talent for. Knowledge without love will remain a lifeless manufacture, not a living growth.—Professor Blackie.

Platinum has been discovered at many points in Canada—in the sands of the North Saskatchewan River in Alberta; in British Columbia; in the Cariboo region; in the copper sulphide of the Yale district; in the copper nickel ores of Sudbury, Ontario; and on the south bank of the St. Lawrence River, in the Eastern Townships of Quebec. Hitherto, however, Canada's contribution to the world's supply has been insignificant.

Practical Questions and Answers

Indicator Spring.

Ques.—What is meant when the springs used in steam engine indicators are spoken of as being number 60, number 80 or some other number ?

Ans.—These numbers signify the scale of the spring. That is, in the case of a 60 spring, it requires 60 pounds pressure to raise the indicator piston against the spring so that the indicator point will rise one inch on the card. Then to find the mean effective pressure in pounds per square inch from a diagram made by a 60 spring one must multiply the average height of the diagram in inches by 60. A 60 spring forms a very convenient diagram for an engine using steam at 100 pounds pressure, and that one is usually made use of. For a gas engine an 80 spring is more convenient.

Refrigerating and Ice Making.

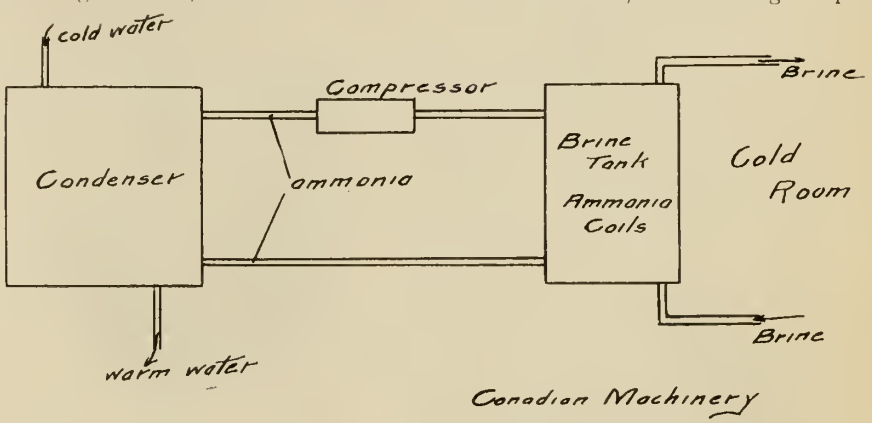
Ques.—I would like to know if it is possible to manufacture ice for home use. How is a refrigerating plant made, or how is ice manufactured ? Some information on this subject will greatly oblige.—Jas. C. Moore.

Ans.—Yes, artificial ice is made very extensively where it is cheaper to manufacture than to import it. The ice is made by artificially lowering the temperature around water to such an extent that the water freezes. The theory of the operation of refrigerating machinery for thus lowering the temperature is as follows : A gas or vapor is compressed by some external force, and then relieved of its heat so as to diminish its volume. This compressed gas is then caused to expand, during which operation the temperature is lowered. The commonest liquids available for use in refrigerating machines are ammonia, sulphur dioxide, ether, carbonic acid and brine. The compressor forms the chief piece of mechanism about a refrigerating plant. Ammonia is the liquid most commonly used for this purpose. The operation of an ammonia compression refrigerating machine is shown in the accompanying diagram. In this illustration are shown diagramatically the chief features of a refrigerating plant, including the cold room, the brine tank and coils through which the brine is circulated, the compressor and the ammonia coils, and the condenser where water is circulated to cool the ammonia. The operation of the plant is as follows : The ammonia is compressed and in passing through the coils in the condenser is cooled. In the brine tank the ammonia is allowed to expand suddenly, during which it absorbs heat from the brine, until the brine falls below the freezing temperature of water. Thus we have a means of freezing water.

There are two methods of ice making, one the "plate" system and the other the "can" system. In the "plate" system the ice gradually forms in from eight to ten days in hollow plates, usually about 10x14 feet in area and fourteen inches thick, the cooling liquid flowing through the plate which is cored for that purpose. In the "can" system the ice is formed in blocks weighing about 300 pounds and requires about 48 hours in the forming. The investment required for the "plate" system is about one-third greater than it is for the "can" system.

Shrinkage in Castings.

Ques.—What is the shrinkage allowance necessary in the making of patterns for castings in iron, brass and steel.



Ans.—The amount of shrinkage depends almost as much upon the style and size of the casting as upon the metal, and in making patterns the style of the casting is always taken into account. The quality of the metal, and the manner of molding and cooling will also have a decided effect upon the amount of the shrinkage. However, for castings where the thickness runs about one inch the following allowances can be made, on good authority : For cast iron, $\frac{1}{8}$ inch per foot ; for brass, 3-16 inch per foot ; and for steel, $\frac{1}{4}$ inch per foot. Thicker castings under the same conditions will shrink less than that indicated, and thinner ones more. The allowance to be made under the various conditions that may arise in order that close work may be done is a matter of experience.

Loss of Metal in Cupolas.

Ques.—What is the percentage loss of metal in melting in cupolas ?

Ans.—From experiments made, it might be said that the loss is between 5 and 6 per cent.

To Start a Suction Gas Plant.

Ques.—Can you supply me with information as to how a suction gas producing plant is started up ?

Ans.—A fire is started in the producer with wood or waste, the small fan, either hand or power as the case may be, being used to blow up the fire, before which it should be seen that the cock on the escape pipe is open to the atmosphere?. Water is then turned on to the vaporizer until it overflows through the pipe provided for that purpose. Water is also turned into the scrubber in order that that may be ready for use when required. More fuel is added to the producer so as to fill it, as soon as the wood or waste fire has caught well. Then the fire is blown for about fifteen minutes, after which time the escape cock is closed, and the gas passes through the scrubber, etc. Now before starting the engine the gas should be tested, and for this purpose there is usually a test cock provided between the scrubber or final sawdust cleaner, if there be one, and the engine. After the gas has been blown through this cock for about five minutes, to insure that there is no air left in the apparatus, a match can be applied to the test cock. The gas will probably burn with a blue flame at first, but as the blowing proceeds the flame will turn an orange color which latter color is an indication that good producer gas is being obtained. After this the test cock can be closed and the engine started.

Of course this operation has only to be gone through when the producer plant is first being started or after it has been cleaned. When closing down for the night all that is required is that the producer be closed up, and the fire left banked. Then in the morning the fire can be blown up, the gas tested and the engine started in a very short time.

PERSONAL MENTION

New Branch Manager.

AN interesting development in the history of Schuchardt & Schutte, manufacturers of machinery, machine tools and specialties, who now have offices and factories in all the principal countries of the world, was reached last week, when they opened a Canadian branch with offices at 13 St. John street, Montreal, in charge of J. Sophus, whose likeness is here presented.

Mr. Sophus is now a thorough-going and enthusiastic Canadian, but he was born in Denmark, twenty-five years ago. His early education was received in that country, but, while still a mere youth he went to England, where he gained valuable business experience for six years. During this time he traveled in Holland, Germany, France and Sweden.

Abont a year and a half ago, Mr. Sophus decided to try his fortune in Canada and entering into partnership with W. B. McLean, under the firm name of McLean & Sophus, carried on the business of mechanical engineers and machinery experts. This firm held the Canadian agency for Schuchardt & Schutte. When the partnership was dissolved, recently, Mr. Sophus retained his connection with them. It was only last week, however, that final arrangements were made, by which Schuchardt & Schutte opened their branch here, and

J. SOPHUS, Montreal,
Manager Canadian Branch Schuchardt & Schutte.

Mr. Sophus was made their Canadian manager.

A full line of Swedish cutlery will be introduced into Canada by this firm next year, but in the meantime they are prepared to push the sales of their "Vesta" cream separator, Gronkvist drill chuck, split steel pulleys and a complete line of shelf hardware.

Mr. Sophus is an enthusiastic and enterprising young man of the type who succeed, and Schuchardt & Shutte have made no mistake in entrusting to him their Canadian business.

* * *

J. W. Davis, Montreal, advertising manager of the Canadian Rand Drill Co., is spending some time in New York studying the advertising departments of large corporations there.

* * *

J. M. Curry, secretary-treasurer of Rhodes, Curry & Co., Amherst, N.S., recently called at the Montreal office of Canadian Machinery, on his return from a business trip to the Pacific Coast.

WM. PATERSON,
of Baxter, Paterson & Co., Manufacturers' Agents, Montreal.

Mr. Wayland Williams, who for the last two years has represented the Campbell Gas Engine Co., has now taken hold of the gas engine department of Messrs. W. H. Laurie & Co., Board of Trade Building, Montreal, the Canadian agents for the well-known Crossley gas engines, suction gas producers, and the Loomis-Pettibone producers.

* * *

Geo. Gurry, retiring general superintendent of the Locomotive & Machine Co., Montreal, was, on Oct. 15th, tendered a banquet at the Windsor, by the heads of departments, foremen and assistants of the works. Mr. Gurry, who has been superintendent for nearly three years, is now leaving to act as general superintendent of the American Locomotive Co.'s plant at that place.

* * *

Mr. C. B. Smith, chairman of the Temiskaming & Northern Ontario Railway Commission, has retired in order to take charge of Winnipeg's municipal hydraulic power scheme. His salary for this will be $5,000 a year. Mr. Smith will retain his connection with the Rail-

J. R. BAXTER,
of Baxter, Paterson & Co., Manufacturers' Agents, Montreal.

way Commission, as consulting engineer, and will continue a member of the Hydro-Electric Power Commission. His salary as chairman was $3,500.

GASOLINE ENGINE PROGRESS.

A NEW company with headquarters at Toronto, known as the British Canadian Engineering Co., with a capital of $250,000, has been established by Mr. John Robson, A.M. I.M.E., of England, to further the gasoline engine trade of this country. Mr. Robson has associated with him J. Mills Wilkinson, vice-president of the Amalgamated Oil Co., and M. J. Miller, of Toronto. They have taken over the business of the Miller Reversible Gasoline Engine Co., and are sole Canadian agents for Pollock, Whyte & Waddell, of Glasgow, manufacturers of the Globe gas and oil engine, and Blackstone & Co., Stamford, England, manufacturers of oil engines. They will also represent one American firm, the Springfield Gas Engine Co., of Springfield, Ohio. This firm will no doubt add considerable impetus to the gas engine trade in this country.

I have grown to believe that the one thing worth aiming at is simplicity of heart and life; that one's relations with others should be direct and not diplomatic; that power leaves a bitter taste in the mouth; that meanness, and hardness, and coldness are the unforgivable sins; that conventionality is the mother of dreariness; that pleasure exists not in virtue of material conditions, but in the joyful heart; that the world is a very interesting and beautiful place, and that congenial labor is the secret o happiness.—A. C. Benson.

Mechanical Reviews

OPINIONS AND STUDIES WORTH NOTING

INSTALLING A STORAGE BATTERY AND BOOSTER.

AT a plant where I was employed a new storage battery of 68 100-ampere cells was required. The battery was selected and the makers contracted to furnish and install the entire equipment, including the battery, a shunt-wound booster set, the switchboard and all cables and wiring. The work was done by experienced men, but the troubles encountered were entirely out of proportion to the size of the job; some of these may be of interest.

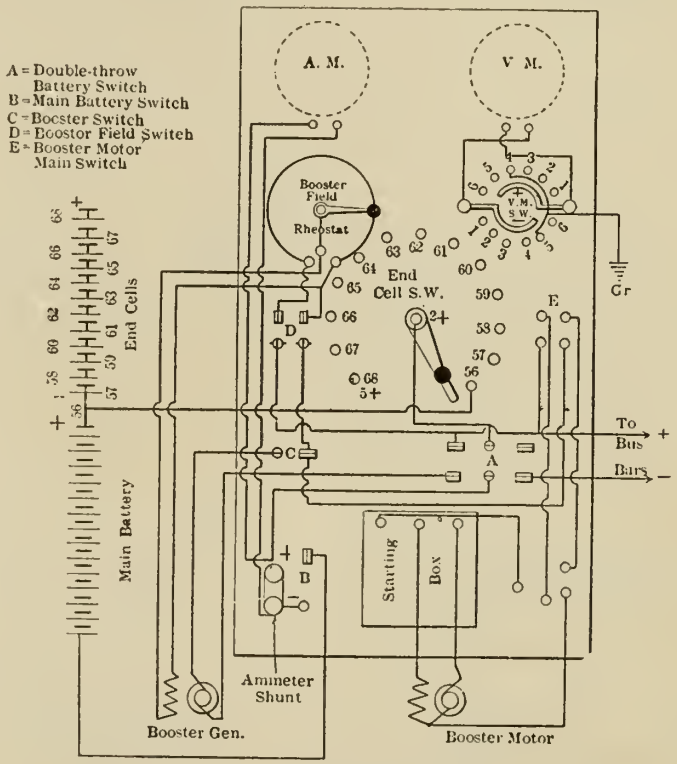
The accompanying diagram shows all the connections of the installation. After the connections were completed they were tested out and declared to be all right, but when an attempt was made to start the booster set, the motor had so little starting torque that it was necessary to give it a pull by hand before it would move; and at other times the starting box would be smoking before the motor was up to speed, and if the resistance was cut out a little too fast the circuit-breaker would come out.

After the booster was up to speed it was found to oppose the electromotive force which it was supposed to boost. This difficulty was remedied by reversing the field connections of the booster, but the motor remained a puzzle. I had an idea as to the cause of the trouble, and when an opportunity presented itself I took a portable voltmeter and proceeded to test the accuracy of my guess. It was a very simple matter to try the voltage of both field and armature with the starting-box handle in several positions, and, as I expected, the voltages of the two circuits were the same for each position of the starting-box arm; this proved that the field circuit was through the starting-box. This diagram indicates that one of the field leads is connected to the starting-box and the field current passes through the coils of the magnet which holds the starting-box arm in the running position. An examination of the starting-box showed that a mistake had been made in the connections, and a few minutes' work put an end to the trouble with the motor.

The next trouble was with the rehostat, which got smoking hot after the machine had been running a short time. The machine was left in my care soon after it was started, and I reported the action of the rheostat, but they concluded it was only the paint choking a little, and let it go on until it was ruined. The plans showed the booster to be excited from the bus-bars and the rheostat to be connected as shown in the accompanying diagram; it will be seen that this is not the usual connection. It is known as a shunting rheostat, the object of this connection being to obtain a finer adjustment of the field voltage than is possible with the usual series rheostat. The rheostat in question had only two binding posts, so it was connected directly in series with the field winding. All things considered, it appeared as if the builders of the machine had made a blunder and wound the field magnet for self-excitation, which proved to be the case, and as the bus-bar voltage was 115, and that of the booster only 50 volts at full load, it was not surprising that the rheostat gave out.

An attempt was then made to operate the booster self exciting, but it was not successful. When starting the charge, the battery voltage and the bus-bar voltage were nearly equal, which permitted not over ten volts on the booster at the time of throwing the battery switch to the charging position, and as soon as the switch was thrown in, the booster would frequently unbuild, and sometimes reverse the field before the switch could be pulled out. It acted so very unsatisfactorily that the experiment was given up in disgust, and the proper field coils and a new rheostat were ordered.

While waiting for these to arrive, we took two rheostats which happened to be available, connected them in series, and managed to pull through. When the new coils and rheostat arrived the coils were changed, but the rheostat was the usual two-connection one, having a resistance of 250 ohms. The matter was again referred to the builders, and after some time, a third binding post was finally sent with directions for connecting it, and no further trouble was experienced in this direction.



BATTERY AND BOOSTER CONNECTIONS.

The battery tanks were made of glass, and as originally set up were placed on stringers with a glass insulator under each corner of each tank, and with lead washers between the insulators and the tanks. The tanks were a source of continual annoyance and expense by breaking, until they were all changed on to sand trays in the usual manner, after which they held all right. —Power.

PROBLEMS IN GEARING.

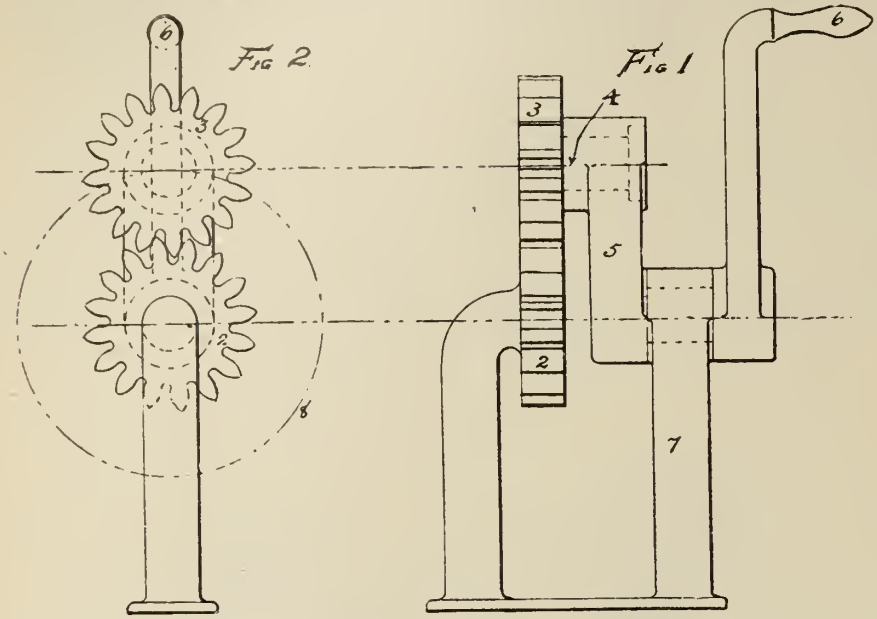
SOME years ago, while designing a machine, I ran up against an interesting problem in wheel gearing, one that every young draftsman should work out and give a place in his notebook. Its solution not only is interesting, but a knowledge of it may save trouble, in my case it almost got to the shop before the error in speed calculation was noticed, and owing to the peculiar construction of the machine it would have been quite costly to have made the necessary changes after the machine was built, as sometimes is done; to say nothing about the cheap feeling a fellow would experience if the thing did not work right. In Figs. 1 and 2.2 is a small gear rigidly secured to the support 1. 3 is a gear having the same number of teeth as the gear 1. 5 is a crank mounted to rotate in the support 7, and is for carrying the gear 3 through the path 8. The problem is by turning the handle 6 one revolution, how many revolutions will the gear 3 make about its axis 4?

Now having satisfied yourself in regards the above, try the following:

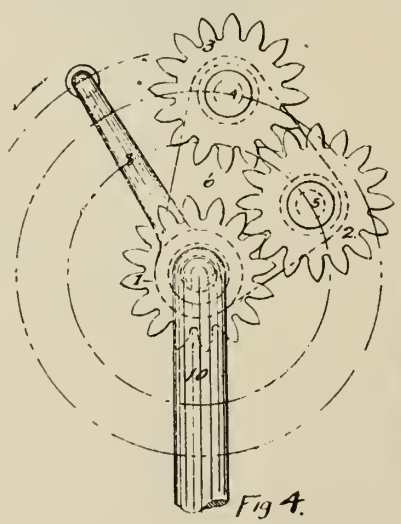
In figures 3 and 4, 1 is a gear rigidly secured to the support 10. 6 is a carrier rotatively mounted in the upright 9. 2 is a gear fitted to rotate on the pin 5 carried by the piece 6, and driven by the gear 1. 3 is a gear fitted to rotate on the pin 4 carried by the piece 6, and driven by the gear 2. Question.—If the gears 1, 2, 3 have the same number of teeth, how many turns will the gear 3 make about its axis if the crank 8 is turned one revolution? Another one. What difference, if any, would it make if the gear 3 should be placed further from the gear 1, that is say that the centres of the three gears were in a straight line instead of forming a triangle as shown?—Browning's Industrial.

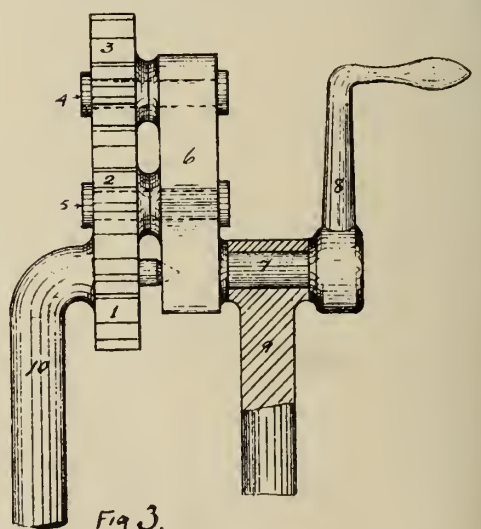
PROJECTION OF WOOD SHAPER CUTTERS.

A PAINFUL and what might have been a serious accident, and the discussion arising therefrom, prompts the writer to contribute this article for the benefit of those engaged in this line of work and others who use machines in which the cutters are fastened to heads which revolve, as do almost all wood-cutting heads.



The accident referred to was one in which the work called for cutters which project a considerable distance out of the slot—in other words, beyond the head—in which position the distance out, added to the high speed and size of cut, created a leverage that made the cutters lose their hold, fly out and inflict a painful wound to the operator's arm. This brought about a discussion in which some of the machine operators about the works contended that the slot in the collars was not cut at the right angle with the centre axis of the spindle, which at its deepest part of the cut, as shown by line (a) in Fig. 2.



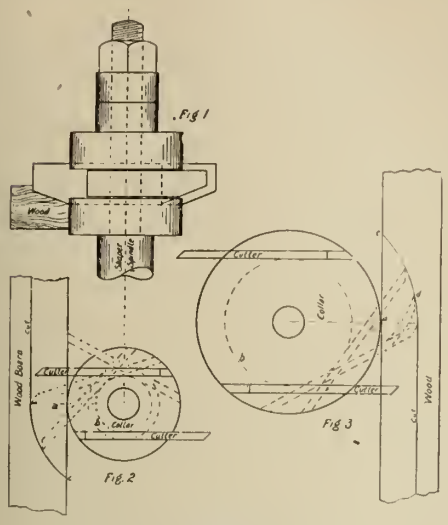


In this the writer wishes to dispel the thought of getting different angles to a cut by having the slot of groove in shaper collars cut at different angles, to give more or less hook to the cutters while in the cut. It cannot be done excepting that the cutters, in their flat position, be nearer or farther away from the centre of the spindle or shaft; no matter if the slots in the collars in which the cutters are inserted were cut in a triangle, to receive three cutters instead of two parallel to each other, as they are usually cut, there would be positively no difference in the cutting unless the collars were larger or smaller, so that the cutters could be placed nearer or farther away from the centre, or tangent to the dotted circle. The same holds good with planer and molder cutterheads; it matters not whether the heads be two, three or four-winged, or more; a difference as to cut can only be created by having the flat of the cutters opposite the centre or axis of the spindle nearer or farther away from this axis, provided the circle scribed by the cutter edge is the same.

By comparing Fig. 2 and Fig. 3 one can readily see that Fig. 3, or the head with the cutters set farthest away from the centre, has the greatest hook when in the cut; all else being equal, this holds true with all cutterheads except those made on the Shimer principle. This is what the writer is trying to explain in Figs. 2 and 3. By shifting the cutters shown by the dotted lines, around the dotted circles, thus bringing them at different angles, but the same distance from the centre, they have the same angle in the cut in each size of head and the same depth of cut for each head, large or small. We have not revolved the spindle, but by the simple shifting of the cutters have obtained the same results in each case as though we had been running the machine.

Another false impression that many machine men have about cutterheads, also set forth by some machine build-

ers, is that a large cutterhead, or one describing a large circle, works easiest. Measuring the line from (a) to (c), in Figs. 2 and 3, it will be seen that the



Projection of Shaper Cutters.

large head is doing one-seventh more work than the small one to obtain the same results. In other words, it takes one-seventh more power to do the same work with the large head, as shown, than with the small one, and the deeper the cut and the larger, the more power required in proportion. The only redeeming feature a large cutterhead has, is that the cutters have more hook and tear themselves through in this way, but the saving created here is again consumed by the power required to keep the larger head in motion, or up to speed, against the wind pressure produced. Cutters are often bent, as shown at (d), to produce both hook to deep-cutting cutters and add to their strength while doing work on this order.

Fig. 1 shows part of a shaper spindle with cutter (s) in position while in the cut; its relative position and proportion of cut is the same as that shown in Figs. 2 and 3. The sketch will explain this better than words.—Wood Worker.

THE MAXIMUM DEVELOPMENT OF THE STEAM ENGINE.

ALTHOUGH would-be prophets have frequently set limits to the development of the steam engine, these limits have one after the other been passed in practice. An attempt is made here to determine if there is any physical reason for setting a limit to the increase in steam pressure and temperature beyond which it will not be possible to go. We have already reached a stage where we can use iron worked red hot, but we can not see that such high temperatures appear likely to occur in the steam engine, even though the temperature in the internal-combustion engine be considerably above red heat. The critical temperature of water and of steam is said to be about 700 degrees Fahrenheit, at which point steam and water have the same specific density and possess the same specific heat. When heated above 700 degrees steam dissociates into its elements. Unless the temperature of dissociation be raised by pressure, 700 degrees would appear to be the limit for the steam engine. Steam pressure rises rapidly with increasing temperature, and at 700 degrees Fahrenheit, or 1,161 degrees absolute, the pressure would be 2,840 pounds per square inch — about ten times higher than any that has been used up to this time. At this high pressure steam would be unstable, and it would probably be found to be desirable to allow for superheating in order to prevent this. If 200 degrees Fahrenheit be allowed for

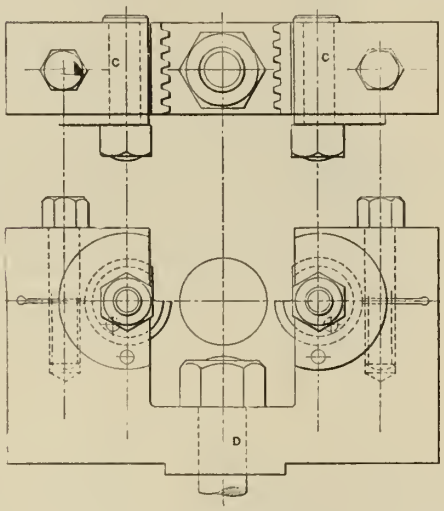


FIG. 1—Double Tool-Post with Circular-Formed Threading Tool.

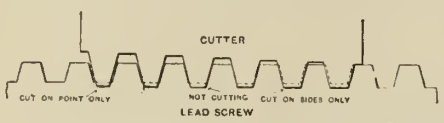


FIG. 2—Illustrating Cutting Action of Tools.

superheating, the absolute temperature of the saturated steam would be 961, which corresponds to about 674 pounds absolute pressure. From this reasoning it seems safe to conclude that it is not safe to set a limit to the steam engine until pressures have attained about 650 pounds by gauge, and temperatures 500 degrees Fahrenheit, with an additional superheat of 200 degrees. — Electrical Review.

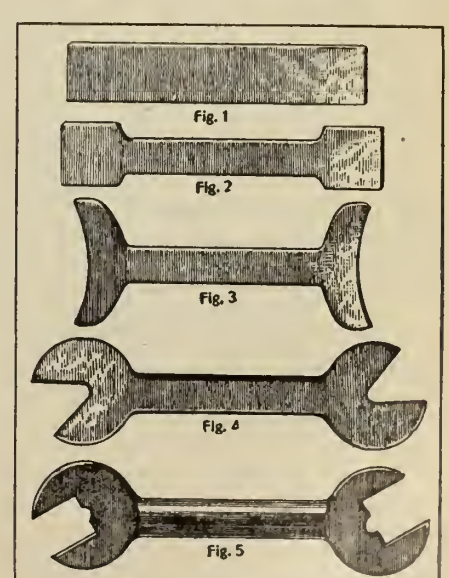
METHOD OF CUTTING LATHE LEAD SCREWS.

THE annexed Fig. 1 shows a method I have used for cutting lathe lead screws which has worked out very well. As usual two cutting tools are used, one in front, right side up, and the other at the back, also right side up, to cut on the reverse trip. The cutting tools in this case were round, like short sections of the screw to be cut but left-hand to cut a right-hand screw. They were cut with the thread on a taper and the outside turned straight so that the leading cutter tooth cut to the full depth that we could take at each traverse and the succeeding teeth widened the cut, only the last two usually cutting in the full side of the thread, as shown in Fig. 2. The limiting element in using this device became the torsion of strength of the screw we were cutting. We found on our 16-inch size that it was cheaper for us to use 1½-inch stock than 1¼-inch on average lengths just on this account because the time saved in cutting more than covered the increased cost of stock.

The bolts (C C) and their washers and nuts were an afterthought and helped to hold the cutters in place. The dowel pins had to be changed every few grindings. Bolt (D) held the device to the top of the cross slide, in place of the tool post.—E.H.F. in Machinery.

HOW TO FORGE A GOOD WRENCH.

FIRST take a file or good buggy spring, according to the size of the wrench wanted, as in Fig. 1. Forge this down 1 in. or 1½ in. from the end, as shown in Fig. 2. Then forge a T on each end and keep the corners round (Fig. 3). Then turn each T on the horn of the anvil and bring one end around a trifle farther than the other, as in Fig. 4. In finishing trim off the ends and square up to suit the nut (Fig. 5). In this way the grain of the steel is forged around each prong,



Forging a Wrench.

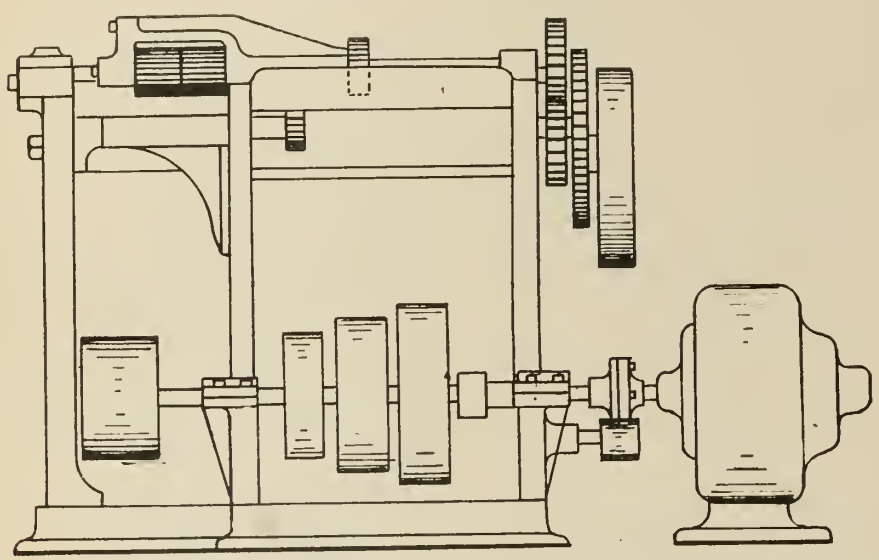
thus making it a good, strong wrench. Never punch a hole and cut it out, as this will make the prongs cross-grained.—Blacksmith and Wheelwright.

Electric Motor in Woodworking Plants

By T. C. Robertson.

ELECTRICITY is attracting greater interest as its possibilities become better known and the appliances necessary for its use become more reasonable in price. Woodworkers are not behind in most matters which affect their interests, especially when it comes to the introduction of apparatus which affects the quantity and quality of their work. Comparisons of the different kinds of power for the driving of machines afford a study of deep interest, and call for careful calculations as well as impartial judgment.

For a number of years electricity has been successfully applied as a motive power and has now attained a reputation which places it entirely beyond the experimental stage. There are now a number of woodworking establishments



MOLDER DRIVEN BY MOTOR

driven by electricity, and the operators seem well pleased with them, and in the near future we will likely see its use in these factories general.

Saving in Electric Drive.

In pointing out the advantages of electrically driven machines, we note first the displacement of a large amount of belts and line as well as counter shafts, thus economizing in power and space. In factories of large dimensions it is estimated that about one-half of the power furnished by the engine is lost in transmitting to the individual machines. This loss may seem large to the man who belts his saw mandril direct from the engine, and it is not applicable in his case, but we must remember in striking an average that there are many woodworking industries which cover enormous floor space, and power must be taken from the engine to the individual machines located on the different floors by means of belts, line and counter shafts. Now, suppose that on the different floors there are machines a considerable distance apart which are run only a few hours in the day, we have probably 50 or 60 per cent. more power required to turn line shafting than is required to run the machines a short period.

In view of the loss referred to it is simply a matter of business to consider any means of saving loss in transmission of power if the proposition does not entail too great cost in equipment of plant. The first thing to do is to demonstrate that a saving can be effected and while this seems to have been done in a number of cases by electricity, still the adoption of such a power seems to gain ground slowly. Perhaps this can be accounted for by a good deal of confusion being generated by estimates having a lack of clearness occasioned by much technical verbiage peculiar to the power under consideration.

In one instance an electrician figured out that the loss between the engine and dynamo was 3 per cent., loss in dynamo 10 per cent., loss in transmission 10 to 15 per cent., incidental loss 5 to 10 per cent., say about 45 per cent. in all. Others figure the loss at about 35 per cent. There seems little doubt that experience teaches that with electrical machines of modern construction that even a smaller loss is sustained.

Other Advantages.

But aside altogether from the question of saving power by electrical transmission, a number of good points can be made in its use. As pointed out, it does away with line shafts and heavy belting, making more room and lessening danger in operation in factory. It gives more room around machines, is a cleaner and more noiseless drive, besides solving the problem of distributing power through the different floors of a large factory in a most satisfactory manner.

Other advantages may be noted. In case of accident one machine may be stopped without interfering with others. The power may be graduated according to the work done. Saving of space for power plant in cases where electrical power can be procured outside of vicinity.

Care Necessary.

Let us now consider some of the difficulties and peculiarities in connection with electric power. The first point is found in care necessary in avoiding an overload in any point of an electric system from generator to the smallest motor. If overload occurs heating will be the result and if continued for any length of time the result will be disastrous to both generator and motor. Suppose for example that a motor is purchased for a certain machine which you want to drive and the estimate is made for an average load, but we are well aware that the average load is often exceeded, especially in woodworking machinery, which would be accompanied with injury to motor. This of course would not occur with a belt drive. It would seem necessary, therefore, that a motor be procured sufficiently large that there would be no slowing down with the heaviest load. This of course applies to generators as well.

In view of these difficulties it is consoling to find in the most recently constructed motors that a perfection is being attained which practically overcomes the difficulty. As a matter of fact the apparatus built to-day will resist more abuse than one could imagine. The improvement consists in installing protective devices in which an overload will cause the current to be automatically cut off, avoiding damage. Almost any builder of such machinery will guarantee 25 per cent. overload continuously without injury to insulators.

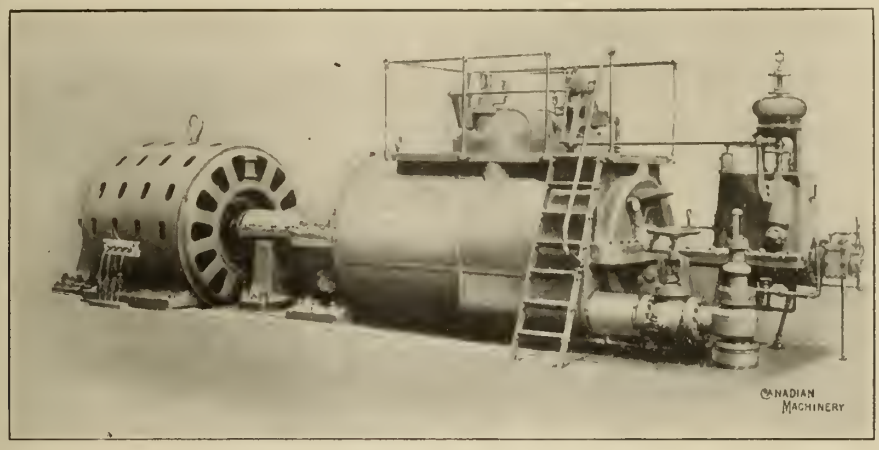
In consideration of these improvements electricity is bound to be the universal motive power of the future in nearly all manufacturing establishments.

The Development of Steam Turbines*

By Prof. Dr. A. Riedler

THE few pioneers who built the first commercial steam turbines were far in advance of their time. The economical control of steam, as well as of dynamic conditions, were lacking, together with suitable materials, the shop facilities, precision of work and. above all, the application and the demand.

The development is unique and peculiar. For a century, the reciprocating engine reigned supreme. Within fifty years



1,000 h.p. Westinghouse-Parsons Generator Unit.

the large industrial units have come into existence, spreading rapidly during the seventies, while the perfect steam engine was not brought out before the end of the century. All of a sudden, the turbine enters, to displace the highest types of reciprocating engines. Ten years ago, the turbine was yet unknown; five years ago it attracted attention. It has been generally appreciated only within the last three years and at the present time power stations use it exclusively.

Since, a few years ago, a great revolution was predicted, we may ask to-day. "What has and what has not been achieved, and what may we expect in the future?" The answer is impossible within a limited time, but facts and experiences can be produced which will give a clear idea of the development and success of the steam turbine.

No Reaction Turbine as Yet.

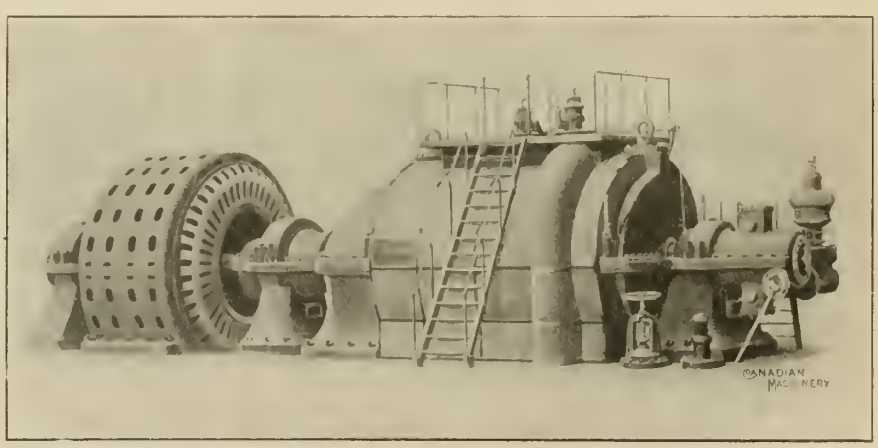
No one has, as yet, built a pure reaction turbine. It proves too intricate and impractical. Turbines with simultaneous reaction and impulse of the steam were brought to perfection by Parsons. His turbine is, at present, the most widely used, with about one and one-half million horsepower in operation. The principle and the simplicity of his turbine is based on the successive expansion of steam in many stages, without separation of the stages from one another, and in the full peripherical steam admission to the wheels of all stages. This principle requires many wheels and from hundreds of thousands to millions of buckets in large turbines.

This objection is offset by an extremely simple construction so that no disadvantage results. It is, however, a drawback to have many wheels running with small radial clearances, which is necesary in order to avoid steam leakage. These small clearances are dangerous with high pressure and superheated steam and they have caused the breaking of buckets. The steam turbine is correct for only one temperature and it is sensitive to changes in thermal conditions. Therefore, the Parsons turbine will have to undergo changes at its high-pressure end, such as are being already tried by Sulzer, in Winterthur, and by Westinghouse. The low-pressure end of the Parsons turbine, however, is excellent and it owes its success to that fact.

Development of Impulse Turbines.

The development of impulse turbines was a great advance in turbine construction. These machines require only half the speed of reaction turbines. The original form which the impulse turbine was given by Laval is not adapted to large nuits, provided, as it is, with a small wheel and gearing. The advance is due to the development of large wheel discs which have been built successfully for peripherical velocities up to 1,200 feet and, furthermore, by the gradual steam expansion in a moderate number of stages, separated from each other by the diaphragms. Rateau was the pioneer in this field, but his machine was brought out with imperfect details and too early, which naturally caused a reaction, though of late most designers are going back to Rateau's fundamental ideas. Several well known turbine types such as that of Zoelly, differ in details from Rateau's construction, but not in principle.

The more recent development of these turbines, with few, but effective, pressure drops is based on the facts that steam nozzles transforming pressure into velocity operate almost without loss, and that when using a correct pressure drop, they can be shaped as simple guide vanes. Thus the machine becomes very simple, with only the disadvantage of having partial peripheral admission in the wheels at the high-pressure end, thereby increasing the rotation loss of the wheels. We are able, however, to fully control superheated steam, applying a quick and effective reduction of pressure, retaining, at the same time, all the advantages of superheat. Heat does not enter the machine at all, being at



7,500 h.p. Westinghouse-Parsons Generator Unit.

* A paper read at the annual meeting of the Society of German Engineers, Berlin, June, 1906.

once transformed into work. The turbine does not suffer under the influence of high temperatures, as do, for instance reciprocating engines. This advantage can be made use of through a gradual velocity drop of the flowing steam, mainly at the high-pressure end. It is on this basis that Curtis and the German General Electric Co. have developed their new turbines, of a very simple and excellent type.

Turbines and Vacuum.

Thus, with simple means and few wheels will be possible the commercially most efficient turbine. Turbines can, furthermore, take the best advantage of condensation while reciprocating engines cannot. To these, a high vacuum causes thermal losses and the necessary areas of passage in the low-pressure steam chests as well as in the exhaust piping, connot be provided for. Owing to its own very low resistance, the turbine on the other hand, can use the highest vacuum to the best advantage, gaining in output both by this vacuum and the reduced wheel friction.

Perfect Accuracy in Manufacture.

The success of the turbine is also due to the excellent development of all details, mainly of the wheels and the buckets. The working speeds for the operation of generators average between 1,500 and 3,000 revolutions per minute. The necessary safety in operation is obtained through careful figuring and design, through safety governors preventing excessive speed, through careful automatic lubrication of all parts, while the governor stops the machine automatically if the oil circulation should be interrupted. Such precautions are necessary, since the increase of speed in turbines cannot be seen or heard, as in reciprocating engines, but remains almost unnoticed; besides, the operation of engines at such a high speed must be assured through great precision of workmanship and care in erecting. While the practice in high-class reciprocating engines requires an accuracy of a few hundredths, modern turbine practice demands a precision of a few thousandths of an inch, chiefly for the balancing of the wheels and the pivoting and control of dynamic effects in general. The requirements which such precision entail on the workshop are extraordinary and signify a radical change. Such precision, however, must be permanently maintained in operation; hence, the most careful automatic service with automatic oil circulation, oil cooling and the above mentioned safety devices. The steam turbine operates either in perfect condition—or not at all. When in perfect condition, it runs without attendance. Should anything fail, owing to inaccuracy or defects, the parts concerned will be completely destroyed in a few seconds. Compared with the reciprocating engine, a great advantage results from these peculiarities. It is, that turbines, once correctly built, remain constant, always with equal efficiency working at the same water rate, without requiring much attention or cost of maintenance, while reciprocating engines must be taken apart after a certain working period. Several turbines can be attended by one man, whereas large reciprocating engines requires several men per unit.

The Field for the Turbine.

The largest field for turbines is in connection with electrical engineering, which, at first, called to its help the high speed reciprocating engine, but it could not get rid of it too quickly for large-scale work. Then, it was necessary to make an unsatisfactory compromise with low-speed reciprocating engines. Electric motors run at high speed, have neither reciprocating forces nor crank motion and they succeeded very rapidly as a consequence. The turbine is the natural continuation to this, forming a homogeneous and logical connection.

Other Advantages of the Turbine.

We should also enumerate the other advantages of the turbine. First of all is the small space required. A turbine capacity of six to eight times that of the reciprocating engine can be provided for on the same floor space. The saving in expense of foundation, building and erecting is very considerable. We have the additional advantages of convenient handling, simple attendance, sparing the personnel from undue strain, and the readiness for starting at any time, in so far as this is not impaired through small bucket clearances.

Where the Turbine Cannot Replace the Reciprocating Engine.

We are, therefore, justified in considering only the turbine for power stations. As a shop motor, however, and for small units it cannot yet replace the reciprocating engine. On the other hand, it is well suited to the driving of high-speed machine tools, centrifugal pumps, blowers and compressors, the development of which will be greatly advanced through the turbine. The low-pressure turbine also finds a wide field of employment, by the use of hitherto wasted exhaust steam from the numerous imperfect steam plants. In these cases the exhaust heat is being stored in accumulators, so as to allow the simultaneous running of exhaust turbines with irregular steam exhaust.

The Manufacture of Turbines.

The remarkable development of turbines and their extreme value in electrical engineering have caused several great electrical concerns to begin the manufacture of turbines as a branch of their regular work, while others have entered into close connection with turbine construction and many leading engine concerns have started building them on a large scale. The manufacturing rights and the different organizations are distributed over all countries.

To the question, "What has been achieved and what may be expected in the future?" we can now give the following answer:

A development of unprecedented rapidity of one of the most difficult motors unique in the history of mechanical engineering; a momentous advance of the highest importance, principally to electric engineering; a sweeping victory in the power station field, although the development of perfect condensers is slightly lagging. The turbine of small size, however, does not yet give full satisfaction in all instances, nor is the marine turbine, as yet, quite developed, being obliged, as it is, to meet special unfavorable conditions.

Summary.

For stationary purposes, the turbine is economically superior to the highest type of reciprocating engines; that is, in its steam and coal consumption. For power plants the turbine is without competition. The latest high-class reciprocating engines of several thousand horsepower were the first, and, at the same time, the last ones of their type. The turbine has displaced the steam engine just as it had reached perfection. For power plants, the turbine is no longer the motor of the future, but of the present.

Stationary turbines present difficult problems because of the required low steam consumption. It is the same with marine turbines, where the coal consumption and radius of operation are the most important factors. In addition, special unfavorable conditions enter, arising from the ship itself and its propeller speed and the high speed of the turbine, which admit only of an unfavorable compromise for the turbine. High velocity of the propeller increases its resistance and losses, while its slow speed means a slow-running turbine and is consequently undesirable. In spite of this, the turbine should consume less steam than a similar reciprocating engine, as it would have to cover the increased losses of a high-speed propeller. The greatest handicap is the lack of systematic experiments on high-speed propellers giving a proper efficiency. The consequence is, a groping in darkness with velocity of from 1,000 down to 150 revolutions per minute, which means from ten-fold to double the present propeller thrust on several propellers and shafts, as Parsons tried to solve the problem, is most intricate and cannot be regarded as final.

BOOK REVIEWS

Scientific Business Letter Writing.—Dealing with the vital factor in the promotion of modern business from a business man's standpoint, by L. E. Ludwig, expert correspondent. 250 pages; price, $1.00. Chicago: Publicity Publishing Co. In this valuable book the author goes into the matter of business letter writing in a thorough manner commencing with the mechanical details, going through and discussing the various phases and situations of the requirements in modern business. It is pointed out that the first requisite of a correspondent is: "He must have a firm belief in what he says." A certain ease and fluency with an orderly way of presenting ideas counts more than the use of grammatical training. The book is designed to be of use to beginners as well as to those of experience. Many a business man with reputation of years of success could no doubt find in this book ideas that would be well to act upon in various contingencies.

Steam Turbine Engineering.—By T. Stevens and H. M. Hobart. An exhaustive treatise on the subject of the steam turbine. 516 illustrations, 814 pages, price $6.50 net. Toronto: 27 Richmond street west, the Macmillan Co. No previous work on the subject of the steam turbine has been published on such an ambitious scale as the volume under review, comprising as it does the theory of the steam turbine from start to finish, both from an engineering and practical standpoint, covering the general field of turbine practice and entering into detail with regard to manufacture. Illustrations and drawings in this book are particularly good. Tables have been compiled and curves drawn from various actual tests, showing the usefulness and also the limitations of this prime mover. No space is taken up with historical matter, but on almost the first page are to be found figures to serve as reference to those interested in the subject. A particularly valuable feature of the book is the bibliography of the steam turbine from 1898 up to the end of 1905. This book is well printed, well illustrated, a good quality of paper being used, and will prove a welcome addition to engineering literature on the subject of the steam turbine.

Air Compressors and Blowing Engines.—By Chas. A. Innes, M.A., lecturer on engineering at Rutherford College, Newcastle-on-Tyne. 290 pages, illustrated with halftones and numerous drawings; price, 4s. 6d net. London: The Technical Publishing Co., Limited. Being specially adapted for engineers the author enters into the mathematics of the subject without much ado, and continues throughout treating the matter from a scientific standpoint. The work deals with the construction of blowing engines and air compressors, being reprinted from a series of articles which appeared originally in the Practical Engineer. The first chapter discusses the properties of air, and shows how to calculate the work required for compression under various circumstances. The second describes several experiments with compressors, and explains the methods of calculating the various efficiencies. The third deals with the theory of valves for equalization of pressure, and the fourth is devoted to the construction of blowing engines. Chapter V. commences the description of air compressors, which have self-acting valves. The remainder of the book is devoted to those with mechanically controlled valves.

Mechanical Draft.—A practical handbook for engineers and draftsmen, by J. H. Kinealy, M.A.S.M.E., formerly professor of engineering at Washington University, with 27 original tables and 13 half-tone plates; 142 pages; price, $2.00. New York: 123 Liberty street, Spon & Chamberlain. The author has assumed on the part of the reader of this book a knowledge of boiler and engine plant. It is designed to facilitate the practising engineer who is called upon to design plants and who must therefore decide when it is best to use some form of mechanical draft. In the general arrangement the book opens with a discussion of the systems of mechanical draft. Forced draft is then dealt with and its advantages and disadvantages discussed. Induced draft is dealt with in the same manner. The proportioning of fuel and air is an important matter and is treated at some length. The subject of draft is then dwelt upon in a general manner followed by chapters on economizers and fans. The final chapter takes up a calculation of proportioning the parts of fans. This book is of real service to all interested in the subject of mechanical draft.

Indicator Handbook.—A practical manual for engineers, being part II. dealing with the indicator diagram, its analysis and calculation. By Chas. N. Pickworth, editor of the Mechanical World. Third edition, 134 pages, illustrated with diagrams. Manchester: Emmott & Co., Limited. In Part I. the author takes up the construction and application of the indicator. This volume deals specifically with the indicator diagram. The effects upon the steam distribution products by defective valve gear and other influences are discussed, while compound engine diagrams and various methods of combining them are dealt with in the following section. A valuable feature of this book in view of the largely increasing use of internal combustion engines is the considerable space devoted to the gas engine diagram. Diagrams from air compressors, air and water pumps, ammonia compresing machines, etc., also receive a larger share of attention than usual.

Water Softening and Treatment.— By William H. Booth, M.A.S.C.E. Treats of the condensing plant, feed pumps and heaters for steam users and manufacturers. 308 pages, well illustrated; price, $2.50 net. New York: D. Van Nostrand Co. As explained by the author the subject of the treatment of water for a steam boiler and manufacturing purposes is a question of prime importance to the steam user, so that no apology is necessary in attempting to bring some of the chief facts connected with the softening of water to the minds of steam users. The finer points of chemistry are not entered into this book, but methods treated of are confined to simple reactions and commercial agents. One of the conditions in which soft water is an essential is taken up in connection with delicate coloring in dye works. Again in the tan yard the presence of lime carbonate in the hides destroys tannin, converting it into lime tannate, which means not only a loss of tannin but detracts from the quality of the leather. A plea is entered for better and more scientific practice in connection with the use of feed water, based on a recognition of those factors on whose permanence and durability depend. The book is divided into five sections, devoted in turn to the treatment of water by softening, oil separation and filteration; air pumps, condensers and circulating pumps; feed heating, stage heating; water cooling; feed pumps and injectors. The author is well known in connection with his already published books on liquid fuel and its combustion, smoke prevention and fuel economy, and his book published in this instance is not behind in quality to those issued earlier.

Power and Transmission

Steam Gas Electricity Compressed Air Water

TEST OF PUMPING PLANT.

IN view of the high efficiency reached by the new pumping plant installed for the City of Montreal on McTavish street, the report of the recent official 24-hour test will be found of interest. The plant consists of a 14-inch 3-stage Worthington centrifugal pump built by the John McDougall Caledonian Iron Works Co., Limited, direct connected to a 400 h.p. induction motor built by Allis-Chalmers-Bullock, Limited. The test was conducted by Mr. George Janin, superintendent of the water works department, and Prof. L. A. Herdt, of McGill University, who reported as follows :

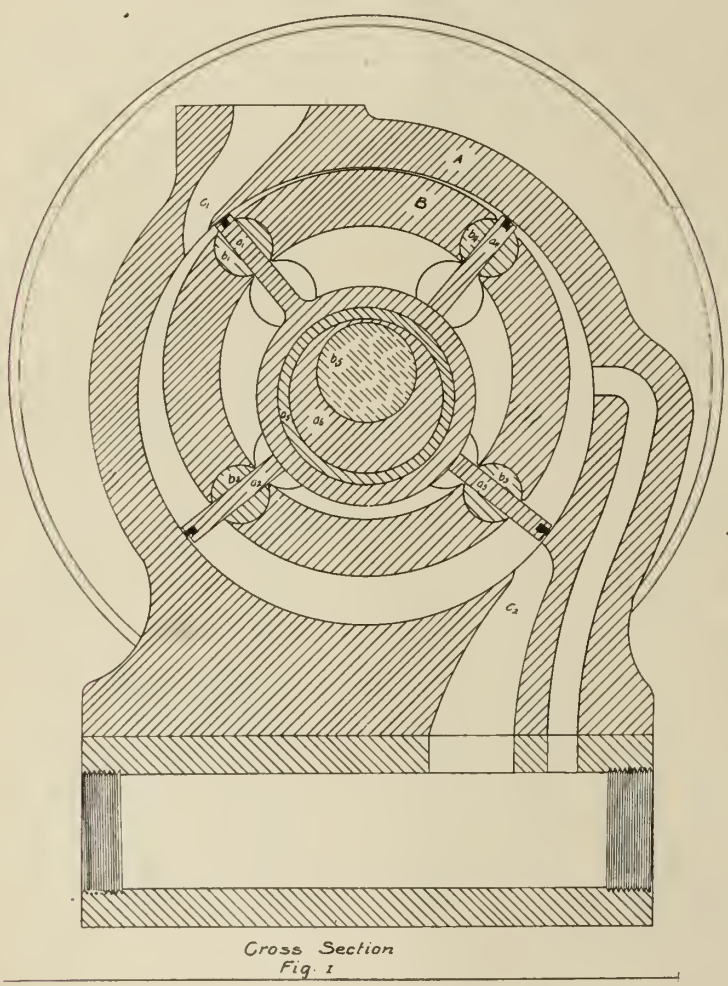


FIG 1.—Cross Section, Free Rotary Engine.

"As the test was to be made in conformity with clause 9 of the contract, on the capacity of the said pump, which was to be five million imperial gallons per 24 hours against 110 lbs. pressure, this condition was amply fulfilled, the total number of gallons pumped being 5,470,000 . The said clause also specified that the test should show that the temperature of the motor working under a full load for at least 12 hours, should not be more than 40 degrees C. above the temperature of the room. The results on this test showed that the temperature never rose beyond 30 degrees C. above the temperature of the room.

"In accordance with clause 10, the ordinary working of the pump and motor was not to cause any notable noise or vibration. During the test, as also during the trials preceding the test, this condition was perfectly fulfilled.

"Clause 11 specified that the pump was to attain an overall efficiency of not less than 65 per cent. The test showed that during normal working, that is to say, with a discharge of five million imperial gallons per 24 hours, this efficiency was attained, and during the period when five and three-quarter million gallons were being pumped, an efficiency as high as 67 per cent. was attained."

The committee was well pleased with the report and it was decided to make the first payment on the plant.

THE FREE ROTARY ENGINE.

AS shown in section in Figs. 1 and 2, the free rotary engine consists of a stationary cylinder or casing (A), a revolving drum (B), which is pressed and keyed onto the shaft (b5), and is concentric with the shaft but is eccentric to the cylinder (A), the distance between the centres being called the "offset." The drum (B) is drilled through in four places and slotted swivels (b1, b2, b3 and b4), shown in Fig. 4, set in. The swivels are made a free fit in their holes. Through the slots in these swivels, work the wings or pistons (a1, a2, a3, and a4). These wings are carried on sleeve (a5), on a hub (a6), which is on the end case and is turned up concentric with cylinder (A), i.e., the cylinder (A), the wings (a1, a2, a3 and a4), the sleeve (a5) and the hub (a6), are concentric with one another, and the drum (B), the shaft (b5) and bearing (b6 and 7) are concentric with one another.

Steam comes through the port (C) into the chamber between the cylinder (A), the drum (B) and the two wings (a1 and a2). As the wings are pivoted on the hub (a6) and fulcrumed on the drum through the swivel, the pressure on the outer part of the wing causes the drum to rotate about the shaft centre, and as the wing (a2) has a greater area exposed to the steam pressure than the wing (a1), the drum turns in the direction from (a1 to a2).

When the drum is turned, so that the wing (a1) is down beyond the steam port, the chamber (a1, a2), is cut off from the steam supply and the steam in chamber (a1 and a2) works the drum around, expanding till the wing (a2) uncovers the exhaust port (c2), when the steam is released. Also, when the

wing (a1) is moved down past the steam port, steam comes into chamber (a4, a1), and starts to do work, so that the torque is uniform and constant, thus doing away with the need of a flywheel.

On each side of the drum (B) are two flanges, (b8 and b9), Fig. 2, (b9) being cast with the drum and (b8) being removable to allow the placing of the wings and swivels. These flanges are not in contact with the sides of the cylinder (A), but a steam-tight joint is made by means of the cylinder rings (a7 and a8), which are on the centre of the cylinder (A) and held out by light springs against the flanges, which are on the shaft or drum centre. The advantage of having flanges and cylinder rings eccentric, is that the rings do not wear in a groove but over a distance on the flanges equal to twice the offset.

The ends of the wings have phosphor bronze strips let into them. These strips are in contact with the cylinder walls and make a steam-tight joint.

Where the shaft comes through the end cases there are double stuffing boxes, which prevent leakage of the steam or oil. The shaft runs in an oil bath, in a babbitt bearing. The engines can be supplied with roller and ball bearings.

No oil is supplied with the steam but oil is forced by an automatic oil pump onto the surface between the sleeve and the hub, the sleeve having holes drilled through it, which allow the oil to escape onto the wings from which it is thrown by centrifugal force onto all the moving parts. This method has been found to insure perfect lubrication.

One or two points are to be noticed in connection with this engine. Each part, perfectly balanced, always turns about its own centre, i.e., there is no eccentric motion of moving parts; the wings, which are carried on the hub concentric with the cylinder, are always in contact with the cylinder and thus make a steam joint independent of springs or centrifugal force; there are no valves or valve gear; these engines are claimed to be lower in weight, require less foundation and have a much lower steam or oil consumption than high grade, high speed engines.

This engine will be manufactured and placed on the market by the Manson Mfg. Co., Thorold, Ont.

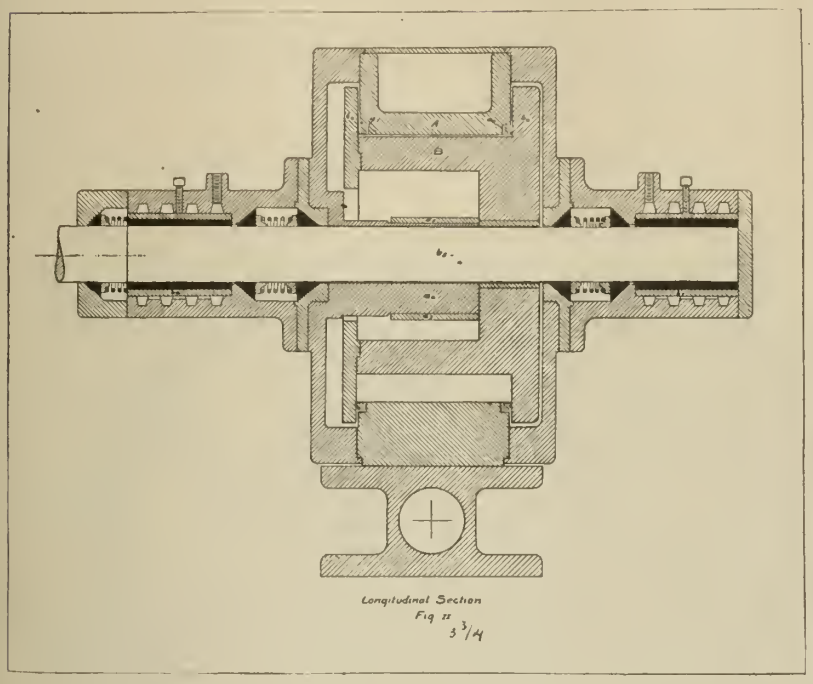


FIG. 2. Free Rotary Engine.

FIG. 3.

FIG. 4.—Free Rotary Engine.

LARGE GENERATORS.

RECENTLY the Ontario Power Co., which operates at Niagara Falls, Ont., decided upon the enlargement of its power house capacity and contracted with the Westinghouse Electric and Mfg., Co. for two of the largest power generators ever turned out at East Pittsburg. These machines are of 10,000 h.p. each, and are called waterwheel generators. The Power Company has already installed four machines of a similar type, which were also furnished by the Westinghouse people. This last contract includes switchboard appliances. The additional power apparatus was made necessary by the great demand for electrical energy to operate manufacturing plants in the company's territory.

BEGINNING OF VENTILATING AND HEATING.

HEATING and ventilating engineering history in this country commences with Joseph Nason, who, upon his return from England in the latter part of 1842, began the introduction into this country of the Perkins system of hot water heating, with which Mr. Nason was thoroughly familiar, having been for some years, while in England, in the employ of Mr. Perkins.

In 1846 a radical departure in the method of heating—in this country at least—was made by the warming of the Boston custom house by means of mechanical propulsion of air. A large coil of three-quarter inch pipe was massed in the basement, and from it to the several registers were run ducts of sufficient capacity to carry the warmed air. This plan of warming, while not new in France, was entirely novel in this country, and was the beginning of all subsequent systems in which fans

were employed for distributing air. The fact that this plan of warming had already been employed in France does not detract from the credit due to Mr. Nason, as there is no evidence that while abroad he went to France, and it is highly probable that he was not familiar with the progress that had been made in that country.

In 1855, in which year extensive alterations of and additions to the United States Capitol at Washington were in progress, Mr. Nason, at the request of General Meigs, then in charge there, went to Washington and planned a system of ventilating and heating for the capitol. This was the first really scientific and complete job of the kind done in this country. Mr. Nason, as this job at the capitol shows, had a thorough knowledge of the business as it was then well known, and was at the time unquestionably the best informed and most experienced person on heating and ventilating in the United States.

The apparatus installed under Mr. Nason's direction consisted primarily of a heating surface of wrought iron pipe, over which air was forced by means of two specially designed centrifugal fans, and conducted through ducts to the rooms to be heated and ventilated.

This plan of having a large amount of heating surface located in one place and the air blown through it, the heated air being then conducted to such places as it was needed, was for some years the favorite mode of heating. Some years after a job of this kind was put in the new post office at Washington. It was also placed in several insane asylums.

In the late fifties B. F. Sturtevant began his work in Boston, which eventually led to his building up the largest blower business in the world. In the course of ten years he developed the blower and its uses to such an extent that it became a recognized factor in satisfactory ventilation. He replaced the U. S. capitol fans with others of more modern design, and about 1870 entered the market with a unit combination of fan and steam heater. From the somewhat crude design of that day has been evolved the present type of fan blower heating apparatus to be found in every important public building and in thousands of industrial plants throughout the world.

Compiled in part from article by R. T. Crane, in the Valve World.

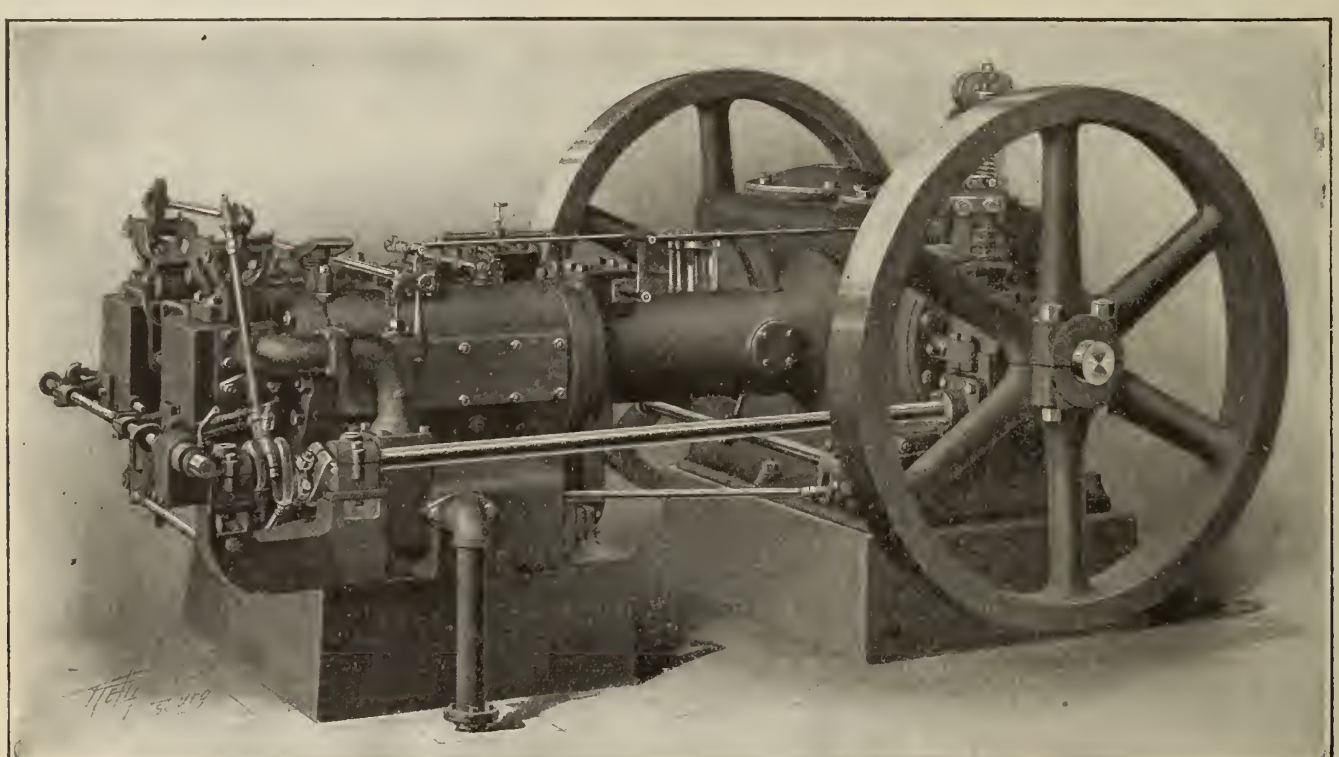


FIG. 1—New Buckeye Gas Engine.

NEW BUCKEYE ENGINE.

A NEW two-stroke cycle gas engine has been developed by the Buckeye Engine Co., Salem, O., which is specially adapted for direct connected dynamo driving, and which operates on producer gas, but which can be adapted to run on any other kind of gas, gasoline or distillate. The engine is a single-acting, scavenging twin engine, and is built in sizes ranging from 25 to 500 brake horse power. The engine has two motor cylinders, with cranks set at 180 degrees, and is provided with two fuel pumps and two air pumps. The accompanying illustration is a general view of the valve side of the engine, showing the secondary shaft operating the valve gear. The piston has a double duty to perform, namely, as well as delivering the power of the explosion to the crank shaft, it compresses the charge in an auxilliary chamber for delivery to the combustion chamber. The crosshead also has a double duty in that it acts as a plunger in an air pump compressing air in a chamber between the crosshead and the cylinder. Each piston compresses its own explosive mixture, and each crosshead plunger delivers compressed air or the scavenging of the combustion chamber of the other half of the engine unit. The cycle of operation is as follows :

When the piston uncovers the exhaust ports, the scavenging valve is opened by the valve gear and compressed air at about 8 pounds pressure is admitted to the combustion chamber from the air pump of the other cylinder. This sweeps out the burnt gases, and the admission valve is then opened, admitting a charge of gas and air from the compressor chamber, which charge is also at about 8 pounds pressure. The piston further compresses the charge on its back stroke, as usual, and the charge is ignited by electric spark. As the piston travels back, compressing the charge in the cylinder, it draws a fresh charge into the other end of the cylinder, and the cross-head plunger

similarily draws in a charge of air. The admission and scavenging valves are operated by wiper cams.

The governor is of the flyball, spring-opposed type, controlling the position of the balanced throttle valves in the fuel passages. Thus the engine is governed by regulating the richness of the fuel mixture.

The engine is equipped with both make-and-break and jump-spark igniters.

The valve gear is susceptible of adjustment for varying the compression and expansion in the working cylinders; the fuel valve can be set to close at any point between the beginning of the compression stroke and half-way of the stroke, thus changing the compression pressure and the release pressure. With the valve closing at half stroke, for example, the gases would be expanded to 1 2-3 times their original volume if the clearance volume were one-fourth the displacement of the piston. The engine can also be adjusted so that the mixture after admission to the working cylinder is at 4 or 5 pounds pressure above the atmosphere, increasing the capacity at a slight sacrifice of thermal efficiency.

The accompanying indicator diagrams were taken from an engine with cylinders 9x12 inches, capable of about 75 horsepower. This engine, it is stated, has a mechanical efficiency of over 85 per cent.

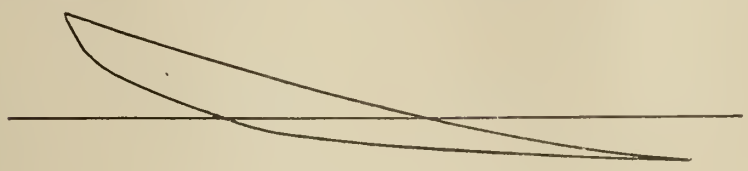


FIG. 2.—Full Pump Diagram; Buckeye Engine.

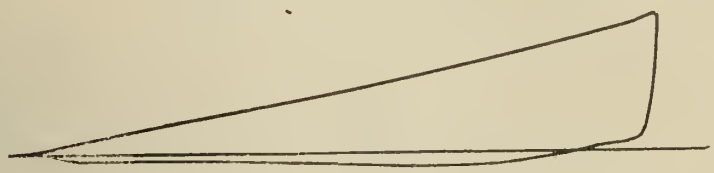
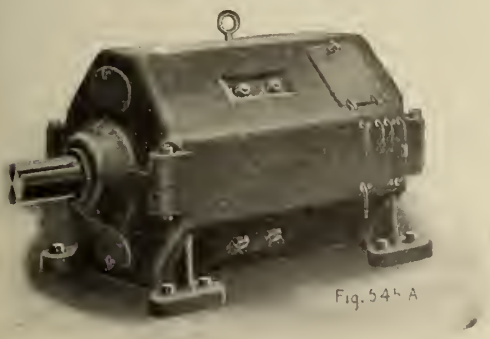


FIG. 3.—Air Pump Diagram; Buckeye Engine.



Motor for Rolling Mills.

MOTORS FOR ROLLING MILLS.

DIRECT current electric motor, type "W," recently placed on the market by the Crocker-Wheeler Co., represents the latest ideas developed to meet the heavy demands of rolling mill service, which require a completely enclosed motor for intermittent but very heavy and jerky work. The suggestions of the best mill engineers throughout the country were invited and have been utilized.

This motor is built for outputs of 25 h.p., 50 h.p., 75 h.p., and 100 h.p., 220 volts only, one speed only, series or compound.

The parts of the motor are very simple and very heavy; and the strength of the parts corresponds approximately to the parts of ordinary motors of about twice the rated capacity of these machines. They are completely enclosed, even the ends of the bearings being sealed so that no particles of dust can enter; and yet the motor can be completely disassembled by lifting the top half after removing four external bolts. The armature is so designed and proportioned with reference to the field that these motors will operate in both directions, under ordinary overloads, without sparking. They are insulated with fire proof material and can be operated in the warmest places.

A complete description of these motors is given in bulletin No. 66, copies of which can be obtained by addressing the Packard Electric Co., Limited, who look after the interests of the Crocker-Wheeler Co. in Canada, at their head office, St. Catharines, or at their offices in Montreal or Winnipeg.

THE CONDITIONS OF FAN BLOWER DESIGN.

THE velocity with which air escapes into the atmosphere from a reservoir is dependent upon the pressure therein maintained and upon the density of the air. The pressure per unit of area divided by the density per unit of volume gives the head, usually designated as the "head due to the velocity." The velocity produced is that which would result if a body should fall freely through a distance equal to this head. In the case of the flow of water such a head always exists; as, for instance, when a stand-pipe is employed to produce the requisite pressure. Suppose the head of water to be 50 feet and its weight per cubic foot to be 62.5 pounds, then the pressure per square foot will be $50 \times 63.5 = 3{,}125$, and that per square inch $3{,}125 \div 144 = 21.7$ pounds. Its theoretical velocity of flow from an orifice at the bottom of the standpipe would be 56.7 feet per second, as determined by the formula for falling bodies, which is $V = \sqrt{2\,g\,h}$ in which

v = velocity in feet per second.
g = acceleration due to gravity.
h = head in feet; here 50 feet.

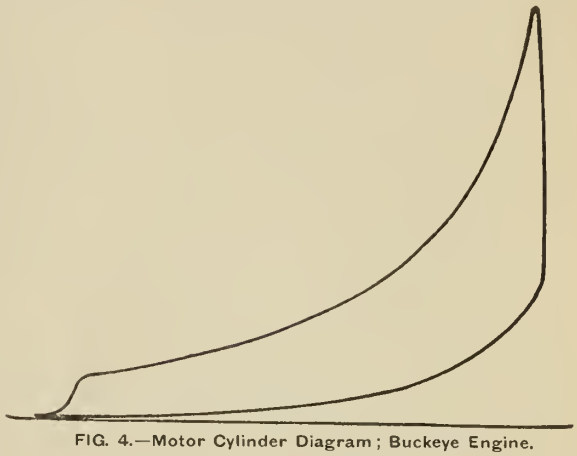


FIG. 4.—Motor Cylinder Diagram; Buckeye Engine.

In the case of air, however, an actual homogeneous head never exists, but in its stead we have to deal with an ideal head which can only be determined by dividing the pressure by the density. As the density of air is so much less than that of water it is evident that for a given pressure the head will be far greater in the case of air. But the velocity of discharge is dependent only on the distance fallen which is represented by the head, whether real or ideal. As a consequence, air under a stated pressure escapes at vastly higher velocity than water under the same conditions. Calculated in the same manner the velocity of escaping air under a pressure of 21.7 pounds per square inch is 1,626 feet per second. By the employment of formulae based upon this theory the elaborate basis tables published by the B. F. Sturtevant Co. have been calculated.

From the preceding discussion it is evident that the pressure created by a given fan varies as the square of its speed. That is, doubling the speed increases the pressure fourfold. The volume of air delivered is, however, prac-

tically constant per revolution, and therefore is directly proportional to the speed.

The work done by a fan in moving air is represented by the distance through which the total pressure is exerted in a given time. As ordinarily expressed in foot pounds, the work per second would, therefore, be the product of the velocity of the air in feet per second, the pressure in pounds per square foot, and the effective area in square feet over which the pressure is exerted.

From this it is evident that the work done varies as the cube of the velocity, or as the cube of the revolutions of the fan. That is, eight times the power is required at twice the speed. The reason is evident in the fact that the pressure increases as the square of the velocity, while the velocity itself coincidently increases; hence, the product of these two factors of the power required is indicated by the cube of the velocity.

The actual work which a fan may accomplish must depend not only on its proportions, but upon the conditions of its operation and the resistances which are to be overcome. Evidently, it is improper to compare fans when operating under such conditions that these resistances cannot be definitely determined. The simplest and most natural condition of operation is that in which the fan is operated without other resistance than that of the case; that is, with open inlet and outlet. For proper comparison of different fans, the areas through which the air is charged should bear some constant relation to the dimensions of the wheels themselves.

It has been determined experimentally that a peripheral discharge fan, if enclosed in a case, has the ability, if driven at a certain speed, to maintain the pressure corresponding to its tip velocity over an effective area which is usually denominated the "square inches of blast." This area is the limit of its capacity to maintain the given pressure. If it be increased the pressure will be reduced, but if decreased the pressure will remain the same. As fan housings are usually constructed, this area is considerably less than that of either the regular inlet or outlet. It, therefore, becomes necessary, in comparing fans upon this basis, to provide either the inlet or the outlet with a special temporary orifice of the requisite area and the proper shape, and make proper correction for the contracted vein. The fan is thus, in a sense, placed in a condition of restriction of discharge, which it approaches in practice only in so far as the resistances of pipes, passages and material through which the air must pass have the effect of reducing the free inlet or outlet of the fan.

The square inches of blast, or, as it may be termed, the capacity area of a cased fan, may be approximately expressed by the empirical formula:

$$\text{Capacity area} = \frac{DW}{X}$$

In which

D=diameter of fan wheel, in inches,

W=width of fan wheel at circumference, in inches.

X=a constant, dependent upon the type of fan and casing.

The value of x has been very carefully determined by the B. F. Sturtevant Company for different types of fans, but these values must be applied with great discretion, acquired through experience and a thorough knowledge of all the conditions liable to affect the fan in operation.

A 20-INCH IRON GROOVED WHEEL.

ILLUSTRATING some of the large work done in Canadian plants, a cut is shown of a cast iron rope sheave, twenty feet in diameter and with seventeen grooves for 1½ in. diameter manilla transmission rope. The pulley as it appears is on the balancing ways in the machine shop of Dodge Mfg. Co., Toronto Junction. Where it was cast and turned, the finished weight was 30,000, lbs., and was judged by the inspector for the purchaser to be one of the nicest large castings he had ever seen.

The wheel incidentally shows the facilities of Dodge Mfg. Co. for turning out heavy castings and machine work.

IT PAYS TO READ ADVERTISEMENTS.

I HAVE noticed that some subscribers to engineers' journals make a big kick on account of their many advertising pages, then again I have seen engineers refuse to subscribe for the same reason.

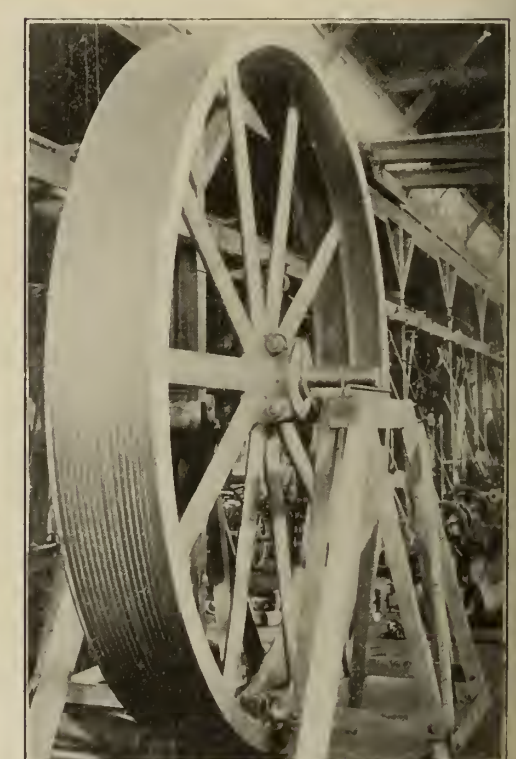
I have found that I get a good deal of information out of the advertising pages, and the more advertising pages there are, the better I like the paper. One keeps posted on the new things which are without doubt very valuable to the man in charge of a power plant to know of, and for this reason alone he should read the advertising pages as carefully as the reading matter.

I wish to relate a few points where I have found the advertising pages of an engineering journal of assistance to me in my work.

The outboard bearing of an engine started to heat one day and we did everything we knew of to make that bearing run cool. Grease was used in the bearing, and to keep things going we had to use graphite mixed with cylinder oil. I noticed an advertisement of a grease which, it was claimed, would make any bearing run cool, and also last much longer than other grease or oil. A small can was ordered from a local dealer, and with it we found that the bearing ran much cooler than before, with less trouble and worry. If I had not have read the advertisement perhaps we would not have heard of the grease.

The piston rod of an engine could not be kept tight with the packing we were using. In the advertising pages of a paper we found just the thing we wanted. Sending for a catalogue to the advertiser, we got full information of their packing, how to order and the price.

Another case was that of a steam line upon which was a union of the malleable iron type and a gasket was used between the two parts of the union.



20-foot Dodge Rope Pulley.

This union could not be kept tight without renewing the gasket about every two weeks.

One day while reading the advertising pages of an engineers' journal I noticed an advertisement of a union, in which it stated that the union would stay tight under all conditions. I thought of that union in the steam line and its troubles, ordered one of the unions at once, and when it was put into place there was no more trouble with a leaky union in that steam line.—H. Jahnke, in Power.

In the up-to-date mill of the near future all small band saws will be fitted by machinery, just as the big band saws for logs now are.

Machinery Development

Metal Working **Special Apparatus** **Wood Working**

NEW AUTOMATIC RACK CUTTER.

HEREWITH is illustrated a new full automatic rack cutter, recently placed on the market by Geo. D. Wolcott & Son, Jackson, Mich. Fig. 1 is a view of the machine with the cover off, showing the mechanism.

3 RETURNED Nov 1/06 to Quinn Cat No 56 Page No 97 asw.

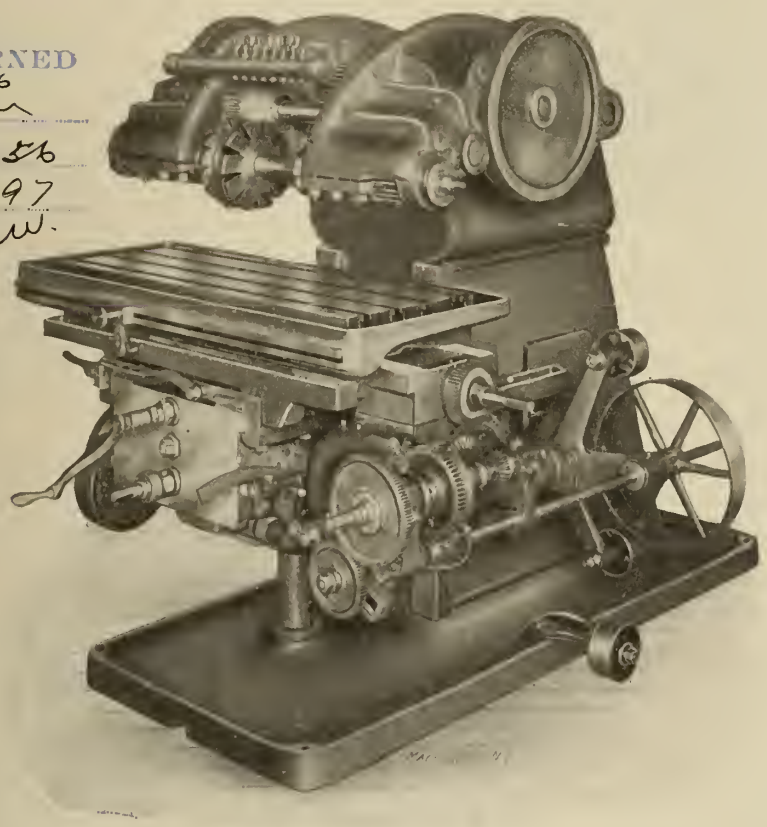


FIG. 1.—Automatic Rack Cutter.

The cutter spindle is driven from both ends, this method of driving being adopted to eliminate vibration and also to secure a powerful drive. The cutter arbor is shown in Fig. 2, together with the two spindles that drive it. (A) is the cutter arbor, having a tongue at each end fitting into slots in spindles (B) and (C). One end of the arbor (A) has a flange integral with it, and the other end is threaded for the nut which secures the cutters. The spindles are hollow and provided with two long studs (D) and (E), which screw into threaded holes in the ends of the spindle; the other ends of the studs are drawn up by the hexagonal nuts (F) and (G) against the washers (K), the inside one of which is of fibre. The flange (H) on the spindle (B) is integral with the spindle, but (I) is a collar threaded to fit fine thread on the spindle (C). This permits adjustment end ways. The collar (I) is split and clamped securely to the spindle (C) when adjusted. Fig. 3 shows the feed and quick return mechanism, the feed by worm gearing and the quick return by bevel gearing. The usual clutch is employed, actuated by a lever from the feed trip dogs.

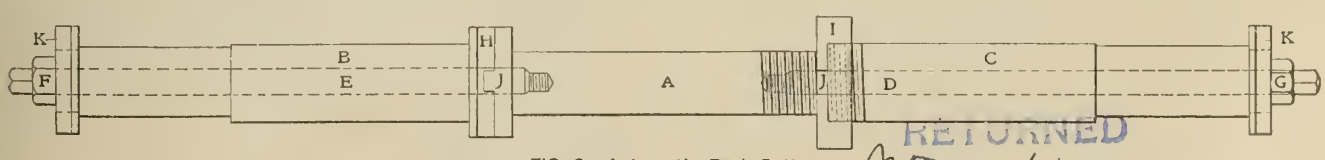


FIG. 2.—Automatic Rack Cutter.

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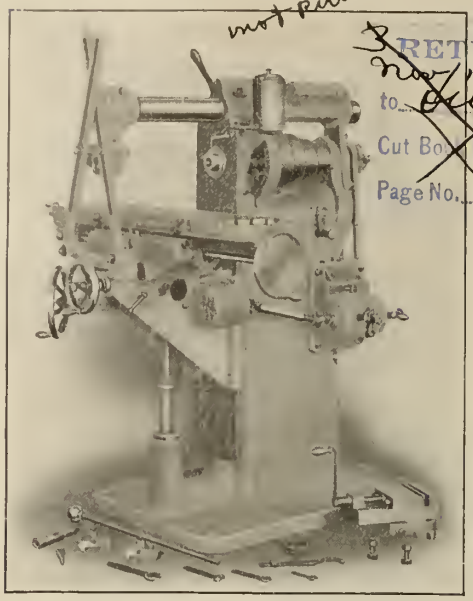
The main drive of the machine is to a cone pulley, and from it a train of gears on either side of the machine drives the spindles. Another train of gears drives the cone on the left side of the main housing and this cone is connected by belt with the cone on the knee which drives the feed and quick return mechanism. On the right side of the machine is the indexing mechanism, driven from above. It consists of two disks, one for a stop and one for a roller. The stop disk is connected with the index screw by gearing. The stop disk and roller disk are connected by a differential shaft and change gears on the front of the apron. As the stop and roller are rigidly fastened together they can both enter only when the opening on the stop disk comes fair with the opening on the roller disk. Thus when the stop and roller are withdrawn the stop disk may make any number of turns, from one to twelve, before the stop can enter again, by varying the multiple indexing change gears on the front of the apron. The change gears are so calculated that a single tooth of each pitch rack to be set over corresponds to a whole number of turns on the stop disk. Thus, having placed the proper change gear for any pitch of rack on the screw, and having placed the multiple indexing change gears on the front of the apron to set over the work the desired number of teeth, when the stop and roller are withdrawn by the indexing trip dog, the table will be automatically moved over the correct amount for the required number of teeth of the given pitch.

On the left-hand side of the machine below the table slide there is a chain which leads from a stop and over a pulley at the back of the machine up to the shifter rod. An adjustable lever on the front of the cross rail releases the chain thus shutting down the machine. The adjustable lever can be set to shut the

machine down when the table reaches any desired point either at or before the end of the blank is reached. The machine will mill a rack 36 inches long by 8 inches wide one diametral pitch or finer. It will index over any number of teeth within the capacity of the machine. It has a range of feeds from ½ inch to nearly 6 inches per minute and will cut one diametral pitch in steel, using one stocking and one finishing cutter, with a feed of ¾ inch per minute. With cutters of high speed steel faster feeds may be used. As the arbor has 10 inches of cutter space on it, it can be entirely filled with cutters when cutting the finer pitches, one-half of the cutters being for removing the surplus stock and the other half for finishing.

BROWN & SHARP MILLING MACHINES.

IN the new catalogue issued by Brown & Sharpe Mfg. Co., Providence, are shown two new plain heavy milling machines. These are entirely new in general design and embrace several important changes. Among the new features are the upward extension of the knee bearing on the column, providing a rigid support to the spindle, and a means of clamping attachments to make them practically a part of the machine itself; a clutch which engages and disengages the entire feed mechanism while the spindle is working; clutches for engaging and disengaging the hand wheels, and the inclosing of the back gears within the column. Both machines are provided with automatic longitudinal and transverse feeds, and the No. 2 heavy machine has in addition an automatic vertical feed. In other respects the two machines are practically identical in general design and mechanism.



Brown & Sharpe Heavy Milling Machine, No. 1½.

Each machine is driven from a four-step cone pulley and is back geared, the gears being inclosed within the column, which adds to compactness and rigidity, and thrown in and out by a crank lever on the side of the column just under the cone pulley. With a three-speed countershaft 16 changes of speed, direct and reverse, are obtained. The positive feed is driven by chain from the spindle to the gear case. There are 20 changes of feed, varying in practically geometrical progression. The positive clutch at the end of the spindle, by which the chain drive and consequently the feed works are disconnected while the spindle is running, permits the operator to use hand feed for delicate work, employing the hand wheels.

The extension of the knee slide to the top of the frame furnishes a stiff support for the front spindle bearing. The

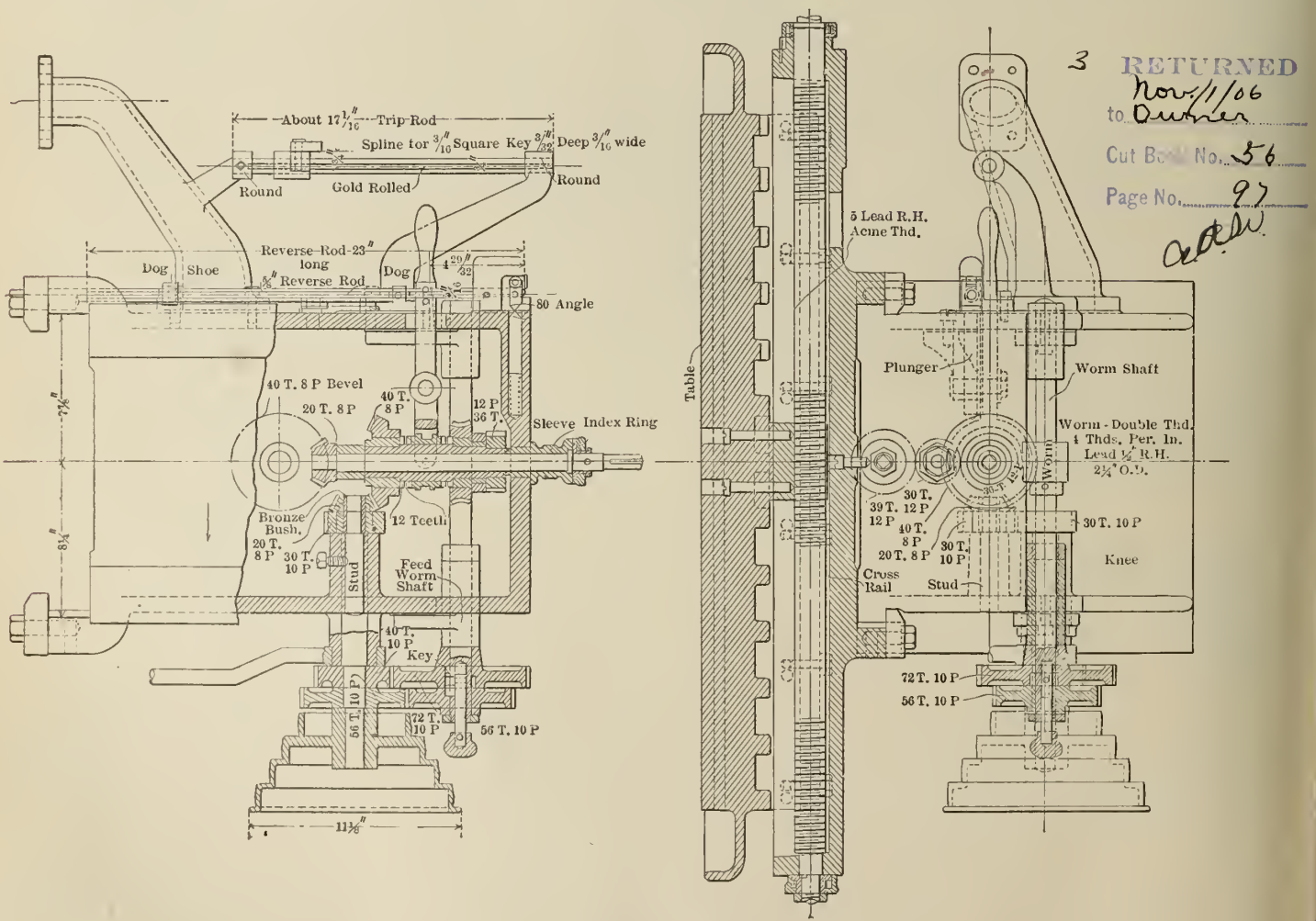
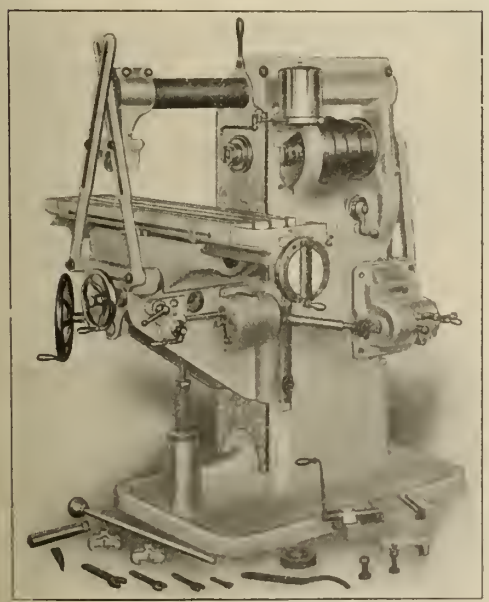


FIG. 3. Automatic Rack Cutter.

crucible steel spindle, running in heavy boxes of special bronze, adjustable for wear, has a hole its entire length, and the front end is threaded to receive a chuck or large cutter and has a standard taper hole. A guard nut is provided for protecting the thread when not in use. The front spindle box projects beyond the face of the column and forms a support to hold the weight of the attachments and relieve the spindle from the strain due to sustaining this weight. It also affords a boss for use in the quick centering of attachments. The extended knee slide makes it possible to clamp any of the regular attachments directly to the face of the column in such a manner that they become practically a part of the machine casting. The overhanging arm is a solid steel bar that can be pushed back when not in use. It is simply and efficiently clamped at both bearings with one lever at the front of the machine, enabling the operator to make adjustments quickly.

Hand wheels are provided for the cross and vertical feed shafts for use when feeding by hand, the operator being thus enabled to follow the rim of the wheel with his hand and easily see the work. As the vertical feed shaft is placed at an angle the operator has control of the various movements of the machine without changing his position or removing any handles. and any two feeds can be operated simultaneously without interfering one with the other. Each hand wheel is provided with a

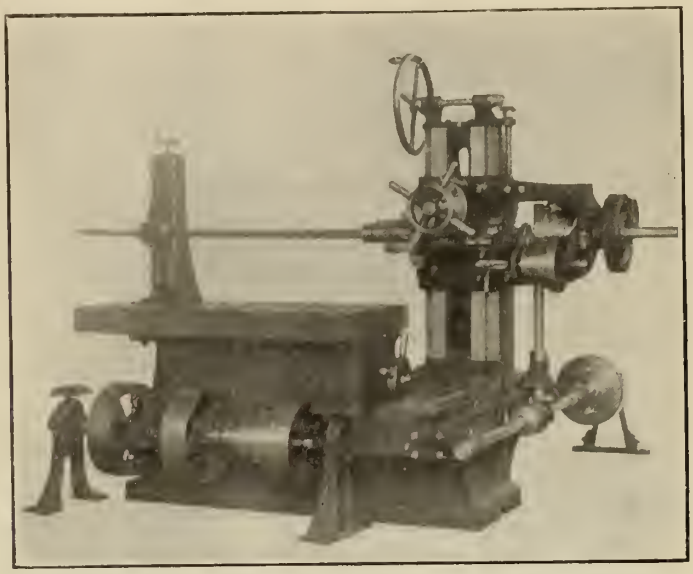


Brown & Sharpe Heavy Milling Machine, No. 2,

clutch that is engaged by a knob at the centre of the wheel, which permits it to remain stationary after adjustment is made and prevents the accidental disturbance of the setting. The levers for controlling the various feeds are located at the right of the knee for convenience in manipulating. One lever on the side of the reverse gear case serves to start, stop or reverse all feeds; the other two levers control respectively the automatic transverse and verticle feeds when machines are so fitted. The table feed screw is not splined, an auxiliary shaft being provided for driving the clutch gears, and as the threads are unbroken the life of the screw and nut is prolonged and the original accuracy maintained. The adjustable dials, tripping mechanism and other mechanical features of the machine are of the standard Brown & Sharpe types.

The No. 1½ machine shown at the right in the engraving, has 16 speeds running from 16 to 318 rev. per min., with eight reverse speeds from 17 to 290 rev. It has a longitudinal feed of 24 in. and a transverse feed of 7 in., both automatic, and a vertical hand feed of 19 in. The 20 changes of feed vary from 0.003 to 0.15 in. per rev. of the spindle. The table has a working surface of 10¼ x 35 in. This machine is adapted not only to tool room use but also to general jobbing purposes, and is a particularly profitable machine for all varieties of the lighter class of milling except the cutting of spirals or work that requires the setting of the table to an angle. The floor space required is 56 x 80 in. and the net weight 2,600 lbs.

The No. 2 heavy machine, shown at the left in the engraving has 16 speeds running from 13 to 439 rev. per min. and eight changes of reverse speeds from 22 to 305 rev. The feeds, all automatic, are: Longitudinal, 28 in.; transverse, 8 in.; vertical, 19 in. The 20 changes of feed run from 0.004 to 0.2 in. to 1 rev. of the spindle. This machine is furnished with hand transverse and vertical feeds when desired. The working surface of the table is 12⅜ x 43 in. The machine occupies a floor space of 61 x 93 in. and weighs 3,600 lbs.



Barnes Horizontal Drill.

NEW HORIZONTAL DRILL.

ACCOMPANYING is an illustration of a new horizontal boring, milling and tapping machine being placed on the market by the B. F. Barnes Co., Rockford, Ill. The machine is adapted for such work as cannot be done to advantage on an upright drill, and is powerfully and rigidly built.

The spindle can be used at any point on a surface 36 inches long and 18 inches high. The machine will be furnished with a boring bar support, as shown in the illustration, if it is desired. The driving cone is fitted with our internal back gears, and the spindle has power feed and automatic stop, as well as hand-wheel feed. A reversing friction countershaft is supplied with the machine. All clamping levers and adjusting hand wheels are readily accessible from the front of the machine.

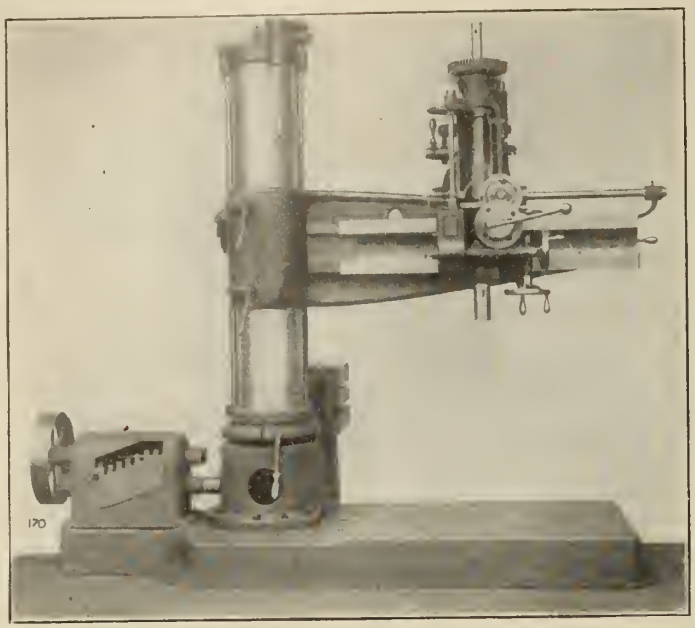
RADIAL DRILL.

THE 4-foot plain radial drill shown in the accompanying engraving is illustrative of three sizes of machines which the Bickford Drill & Tool Company of Cincinnati, Ohio, is just placing on the market.

One of the chief features of this line of tools is the large number of speeds with which they are provided. The speeds vary, of course, with the size of the tool, the minimum speed of the 6-foot radial being adapted to driving a 6-inch pipe tap, that on the 5-foot to a 5-inch, and that on the 4-foot to a 4-inch. The

range, however, is identical on them all. i.e., the maximum speed on each is 13.63 times the minimum speed, the only difference being that each series starts from a different figure.

The speeds on the 4-foot radial range



Bickford Radial Drill.

from 22.5 to 307 revolutions per minute as shown in the accompanying table, in which it will be noticed that suitable speeds are provided for drilling all diameters advancing by 16ths from 7-16 to 7-8 inclusive, 8ths from 7-8 to 2¼ inclusive, 4ths from 2¼ to 3½ inclusive.

This large number of speed changes adapt the machine to metals of all degrees of hardness as the gradation is so slight it is never necessary to run the spindle at a speed much under the limit of endurance of the drill.

The speeds are obtained by means of two levers, one of which is located on the head and controls the three back-gear speeds while the other projects from the speed box located on the base and controls the eight speeds furnished by that mechanism. Of these 24 speeds only one varies from the theoretically correct by so much as 3.11 feet per minute, and as each and every speed is instantly available and is said to have ample power behind it for drilling from the solid the diameters of holes given in the table, it appears as if the builders had met every requisite of the most exacting operator.

The speed box is patterned after the one brought out by the same company the forepart of last year, a description of which appears at page 361 of our issue of September 14, 1905. The eight speeds which it furnishes are obtained from twelve gears, only three of which are in service at a time, whereby wear is reduced to a minimum. So far as appearance and the positiveness of its speeds are concerned, the mechanism may be said to belong to the tumbler gear variety of speed-change device, but inasmuch as the maximum difference in the periphery speed of its gears is confined to the comparatively narrow limit of 2 to 1, such shock as occurs at the moment of changing from one speed to another is nearly or wholly absorbed by the driving belt.

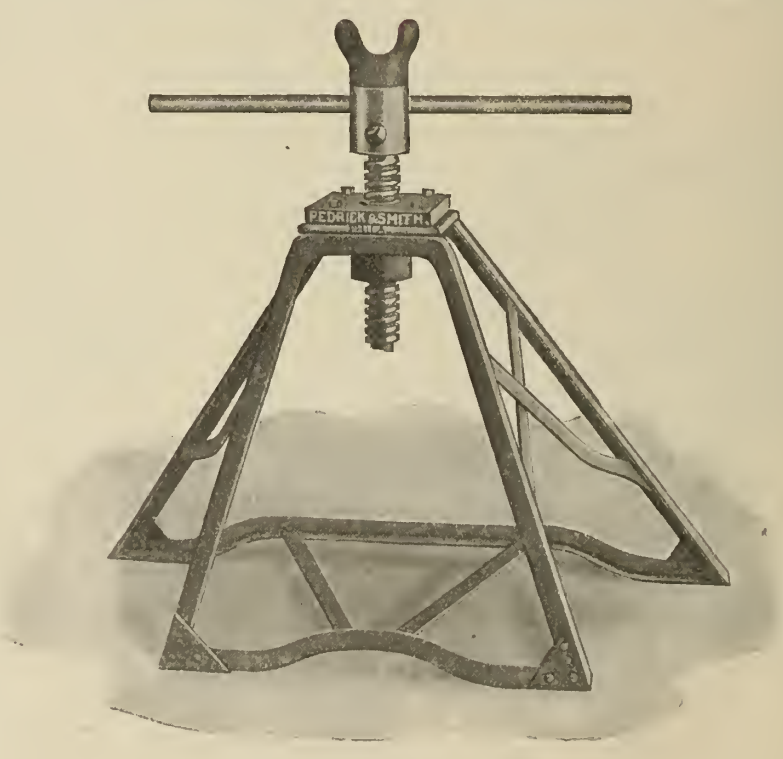
The tapping mechanism is located on the head and permits the backing out of taps at any speed with which the machine is provided regardless of the speed used in driving them in. It is fitted with a friction clutch operated by a lever, the handle of which extends around under the arm within convenient reach of the operator and is used for starting, stopping and reversing the spindle.

The depth gauge answers a double purpose; besides enabling the operator to read all depths from zero, which does away with the usual delays concomitant to scaling or calipering, it supplies a convenient means for setting the automatic trip, the graduations showing exactly where each dog should be located in order to disengage the feed.

The automatic trip operates at as many different points as there are depths to be drilled at one setting of the work; in addition, it leaves the spindle free, after any intermediate tripping, to be advanced, or raised and advanced, or traversed its full length without disturbing the setting of the dogs; it also throws out the feed when the spindle reaches its limit of movement.

STEEL SCREW CAPSTAN CABLE JACK.

The accompanying illustration shows a new style of structural steel screw capstan cable jack, designed and built by



Machine Screw Capstan Cable Jack.

Pedrick & Smith, Germantown, Philadelphia, Pa. It is specially designed for telephone and electric companies and the illustration explains itself.

ABOUT CATALOGUES

By mentioning Canadian Machinery to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

Edward Van Winkle, Consulting Engineer and Attorney at Patent Law, New York, issues a dainty little booklet devoted to engineering and patents, showing the author's connection with these fields.

Air Compressors. — A catalogue devoted to a slight extent to a history of air compressors, but in the main to a list of the users of air compressors manufactured by the Chicago Pneumatic Tool Co., Chicago. 30 pages, 4 by 9.

Educational and Industrial Efficiency. —Report of Albert H. Leake to the Minister of Education on recent development in the schools of the Eastern States. It is issued as an appendix to the Report of Education, and contains some interesting matter on subject of technical education in actual practice ..

The Silent Partner. — No. 7 of the interesting little house organ issued by the Globe Machine & Stamping Co., Cleveland. While containing some advertising matter for the company the book contains many thoughts for the busy man. Everyone should have a copy of this fine little publication. 16 pages, 4 by 7.

Telephone Exchanges. — Private branch telephone exchanges are described and illustrated in the catalogue of the Stromberg-Carlson Telephone Mfg.Co., Rochester, N.Y. This catalogue describes the various apparatus and equipment, as well as the exchanges complete, in an interesting manner. 42 pages, 6¾ by 9¼.

Telephone Catalogues. [illegible] catalogues issued by the Stromberg-Carlson Co., Rochester, N.Y. One of these describes the making of a cable, another how the telephone helped the farmer. Mine telephones are described in a little book entitled Mine-A-Phones, which is devoted to the use of telephones in mines.

American Turret Lathes.—The sheet from the Gisholt Machine Co., Madison, Wis., illustrating and describing the 24-27 semi-automatic turret lathe, formerly made by the American Turret Lathe Mfg. Co., which company the Gisholt Machine Co. bought out. There is also illustrated and described their 24-32 semi-automatic gap turret lathe.

Steel Pressure Blowers.—Bulletin No. 134 in the Sturtevant Engineering Series has just been issued by the B. F. Sturtevant Co., Hyde Park, Mass. It is entitled "Steel Pressure Blowers" and relates to high pressure types of fan blowers for foundry and similar uses. It contains a valuable table of fan capacities for various size foundry cupolas.

Lubricators, Oil Cups, Etc.— The Michigan Lubricator Co., of Detroit, has just issued a catalogue of 108 pages, illustrating and describing their very complete line of lubricators, oil cups, oil pumps, grease cups, and other trimmings for steam engines, gas and gasoline engines, air compressors, boilers, etc. This handsome book will be mailed free of charge to anyone interested.

Inspection Bureau. — The firm of Plews & Trimingham, of Montreal, have undertaken and already well established the formation of an electrical Lux. An interesting little booklet described as a miniature magazine of light literature, devoted to short stories with morals showing the progress made in modern lighting, culminating in the Nernst lamp manufactured by the Nernst Lamp Co., Pittsburg, Pa.

P. D. Dods & Co. —The 112 pages of this cloth-bound catalogue contain a wealth of information regarding Island City paints and varnishes. The lines covered in their manufacture include every variety used industrially. Of particular interest to readers of this paper is the line of machine paints comprising 6 colors. These are made in paste form and can be used as a filler applied with a knife or thinned with turpentine and brushed on.

Clay Working Machinery. — Catalogue No. 50 of the American Clay Machinery Co., Bucyrus, Ohio. A handsome cloth-bound book, profusely illustrated and well printed, describes the various machines manufactured by this company. The machines manufactured include a full line of brick making machinery, terra cotta lumber, clay conduit, sewer pipe presses and all machinery accessories for the running of these plants. 227 pages, 8½ by 11.

Friction Clutches.—David Bridge & Co., engineers and millwrights, Castleton Iron Works, Castleton, Manchester, Eng., have issued a cloth-bound catalogue describing friction clutches, shafting, gearing and hauling installations. The catalogue is well illustrated and contains various tables of sizes as well as useful information regarding the belt phylosophy transmitted by belts and shafting and equivalents of millimetres in inches. 199 pages, 5 by 7½.

Wooden Stave Piping. — The Pacific Coast Pipe Co., of Vancouver, issue a catalogue describing wooden stave pressure and conduit pipe as manufactured by them. The various lines include all sizes of wooden pipe from 3 inches to 5 feet, for both low and high pressure water works mains. Besides being a catalogue of this firm's output showing the advantage of wooden pipe, this book devotes about 20 pages to giving valuable data on hydraulic. 64 pages, 5 by 8.

Centrifugal Blowers.—Bulletin No. 133, recently issued in the Sturtevant Engineering Series, published by the B. F. Sturtevant Co., Boston, Mass., is a pamphlet of sixteen pages. This bulletin is designed to illustrate from actual photographs Sturtevant centrifugal gas blowers and exhausters installed in a few of the best and largest gas plants in the country. It contains a valuable table showing the various sizes and capacities of blowers and exhausters designed for gas plant work.

Taps, Dies and Screw Plates.—The Canadian Tap & Die Co., Limited, Galt, have just issued a handsome catalogue illustrating their various lines of manufacture. The trade name of these goods is "Little Giant," and includes screw plates, taps, dies and collets, adjustable tap wrenches, machinists' hand taps, machine nut taps, as well as various other kinds. Some valuable information regarding the United States v. Standard and Whitworth Standard Threads, is given, besides a table of decimal equivalents. This catalogue should be in the hands of all machinists and dealers. Size, 5 by 7½. 50 pages.

Machinery and Tools. — One of the finest catalogues that has yet been received at this office is to hand from Patterson, Gottfried & Hunter, Limited, manufacturers, importers and jobbers of machinery, metals, hardware, tools and supplies, New York City. It is bound in a Moorehouse catalogue cover, the catalogue being in bulletin style. A splendid feature is the insertion of cross section note paper between the different bulletins. An index at the back refers the reader to any particular machine or tool required, which may be found with little trouble. Besides various machine tools and wrenches, various styles of pulleys and hangers and countershafts are described. Grinding machinery and supplies are also a feature of this catalogue, and considerable space is devoted to engineering supplies. This catalogue should be a valuable acquisition to the files of any manufacturer or dealer in these lines. 715 pages, 7½ by 11

Industrial Progress

CANADIAN MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired

T. Prefontaine will erect a sash and door factory at Montreal.

The Montreal Steel Co. will increase their capital by $500.000.

The Sydney Cement Co., Sydney, C.B., will build a large plant.

The Defiance Iron Works, Chatham, will be greatly enlarged.

Thos. M. Ruston, Brantford, Ont., will erect a planing mill at that place.

The assets of the Imperial Foundry Co., Ottawa, were sold on Oct. 16.

The Moose Jaw Carriage Works Co. is erecting premises in Moose Jaw.

The Cape Breton Foundry Co. will establish a foundry at Sydney, C.B.

Portage La Prairie will endeavor to secure electrieal power from Winnipeg.

The Berlin Rubber Co., Berlin, Ont., will establish a branch at Calgary, Alta.

The Dominion Steam Heating Co. propose to erect a large plant at Galt, Ont.

The Polson Iron Works, Toronto, will extend their plant at a cost of $100,000.

J. I. MacCracken, of Ottawa, will erect an iron clad foundry at that city.

The Borland Carriage Co., Stratford, purpose making a large addition to their factory.

The Sawyer-Massey Co., Hamilton, will increase their plant at a cost of $30,000.

Winnipeg's building permits for 1906, up to October 16th, amounted to $11,366,700.

The Alberta Biscuit Co. will erect a factory at Calgary, Alta., to cost about $55,000.

The Sutherland Rifle Sight Company will erect a $20,000 factory at Westville, N.S.

The Northern Brass Company, of Winnipeg, will erect a new building to cost about $25,000.

A by-law dealing with the new $300,000 foundry proposition will be voted on at Berlin, Ont.

The Moose Mountain Lumber & Hardware Co. are erecting new premises in Kisbey, Sask.

The Seaman Kent Co., of Meaford and Toronto, will erect a factory at Winnipeg, Man.

The Toronto Railway Company will erect an electrie sub-station to cost about $10,000.

The Cape Breton Foundry Company will commence the erection of its plant at Sydney, N.S.

The Cockshut Plow Company, Winnipeg, will add a three-storey addition to their warehouse.

H. R. McLellan and others, of Sydney, C.B., have taken over the Mowry Safety Nut Co.

A new Industrial School to be erected near Cranbrook will cost between $30,000 and $40,000.

The Vulcan Iron Works, of New Westminster, B.C., are erecting a large addition to their plant.

The Canadian Bridge Co., of Walkerville, Ont., are building extensive additions to their shops.

The Sherwin-Williams Paint Company have started work on a $40,000 warehouse at Winnipeg.

Improvements amounting to $6,000 have been made to the Ham & Nott factory in Brantford.

It is rumored in Brantford that the Grand Trunk will remove its Stratford shops to that city.

Wm. Neilson, will erect a factory and stable on Gladstone avenue, Toronto, to cost about $15,000.

Cowan & Company, of Galt, Ont., are making extensive additions and improvements to their shops.

A Vancouver syndicate will build a large hotel on property adjoining Stanley Park, Vancouver.

The Quebec Government have completed plans for a new jail in Montreal to cost about $1,000,000.

Work on the new premises of the Dominion Pipe Co., in New Westminster, B.C., has commenced.

The Peterborough Shovel Co. will erect an addition 40 x 115 feet to meet their growing business.

The Maritime Railway and Power Company are erecting a new power house at Chigneeto, N.B.

The Royal Alexandra Theatre, now under construction in Toronto, will cost $150,000 when completed.

The Chapman Double Ball Bearing Company are erecting a new factory on Sorauren avenue, Toronto.

The Montreal Street Railway is considering an inerease in its capital from $7,000,000 to $9,000,000.

The Standard Gas Holder & Boiler Construction Co., of Belleville, Ont., have obtained a charter.

The C.P.R. will erect a new building at Moose Jaw, Sask., to supply acetelyne gas for passenger coaches.

The Kakabeka power plant has been opened, placing at the disposal of Fort William 12,500 horse-power.

A new mica factory affording employment to 400 girls, will be established at the Chaudiere Falls, Ottawa.

The planing mill of John Arbuthnot & Co., Fort Rouge, has been destroyed by fire, causing a loss of $25,000.

When the new electric light plant is installed at Calgary, Alta., it will cost in the neighborhood of $100,000.

The Oliver Motor Car Company, recently formed to manufacture the Oliver traekless car, has located in Sarnia.

The Tudhope Carriage Mfg. Co., of Orillia, have bought land in Edmonton on which to erect a branch factory.

Welland has passed a by-law furnishing sites and sewerage to the Canada Forge Co. and the Supreme Heating Co.

The Strathcona Radial Tramway Co. are seeking franchise to build an electric railway between Strathcona and Edmonton.

Contracts will soon be let for the work in connection with the erection of the Collegiate Institute at Brandon, Man.

The Acadia Sugar Refining Company, of Moncton, will double the capacity of the Moncton barrel factory, Moncton, N.B.

W. E. Buckingham, of Guelph, representing Michigan capitalists, contemplates starting a paper mill in Toronto.

A saw mill of a daily capacity of seventy-five thousand feet is to be erected by American capitalists on Craeroft Island.

The Canadian Paeific Railway will erect a skyscraper on the northwest corner of King and James streets, Hamilton.

Hastings has voted to give the Peterborough Boiler & Radiator Co. a bonus of $5,000 and exemption from taxes for ten years.

The Manufacturers' Gas Co. have struck another gusher near Selkirk, Ont., the flow is said to exceed 1,500,000 feet per day.

The Canadian Northern Railway Company will erect shops at Montreal and at Fort Rouge, Manitoba, to cost about $1,000,000.

The Western Canada Coal & Cement Company, which is now preparing to operate in Kananaskis, Alta., will locate in Calgary.

Daniel O'Connor and W. A. Maus, representing Peterboro capitalists, may loeate a rolled steel plate mill at St. Catharines.

The Meisel Manufacturing Company and the Port Huron Engine & Thresher Company are about to erect factories in Port Arthur.

The Canadian Iron & Foundry Company, of Fort William, are about to

erect a large foundry. J. R. Duncan will be the manager.

Messrs. Mason, Sturgeon and Davidson of Peterboro, have purchased land in Hastings, Ont., on which to erect a radiator factory.

H. F. Anderson & Co. wholesale implement dealers, of Winnipeg, are making arrangements to open a branch warehouse in Regina.

The Dominion Iron & Steel Co. turned out 1,020 tons of steel rails last Saturday, breaking all records for a 24-hour production.

A Canadian branch of the Kendel Bell Co., of St. Louis, will be located in Toronto. They will employ about twenty-five hands.

Canadian Westinghouse, Hamilton, are installing in their plant three jib cranes, the product of the Smart-Turner Machine Co., Hamilton.

The Shipway Iron, Bell & Wire Manufacturing Co. will shortly make application for a charter, and will establish works in Niagara Falls.

Toronto's building permits up to October 23 represent a value of $11,000,000. The total for twelve months last year amounted to $10,337,000.

The Hart Parr Gasoline Co., St. Charles, Iowa, are considering the erection of a plant in Kenora, Ont., for the manufacture of their product.

The boring for natural gas at Calgary has resulted in the discovery of a pocket of gas at 760 feet, but the pressure is very slight and not of value as yet.

Port Colborne has carried a by-law granting exemption from taxes to the Great Lakes Portland Cement Co. and the Canadian Portland Cement Co.

The Smiths Falls Malleable Castings Company intend to duplicate their present plant, having bought about 12 acres of land to allow for the enlargement.

The new shops of the Perth Bolt & Forging Co., Limited, Perth, Ont., are rapidly being completed. And the company hopes to be running in December.

The Sanderson Mfg. Co., Sydney, N. S., have been incorporated with a capital stock of $45,000. They will manufacture roofing material, tar paper, etc.

A wealthy syndicate is being formed in Victoria and Vancouver to build a brick factory and exploit marble and sandstone deposits in British Columbia.

Symmes & Co., Niagara Falls, have been awarded the contract for supplying natural gas to Chatham. The gas will be brought from the Tilbury fields.

The Canadian Pacific Railway Co. will build another big extension to the Angus shops at Montreal to cost about $70,000. The new building will be 672 x 100 feet.

Heap's saw mill, Cedar Grove, near Vancouver, B.C., has been completely destroyed by fire. The loss is estimated at $200,000, partially covered by insurance.

The Central Heating Co., Hamilton, have amalgamated with the Dominion Heating Co. of the same city. The company will not be ready to do business this winter.

J. M. Fleming, of Ottawa, and others, purpose starting a factory in Iroquois, Ont., for the manufacture of certain patents in connection with machine shops.

The Toronto-Niagara Power Co. have purchased a block of land on Dufferin street, Toronto, and intend erecting their shops and transforming station on the site.

H. W. Sanders, of Sydney, N.S., representing eastern capital interested in iron and steel, is in the west looking for a location for crucible steel and stove works.

The Maritime Coal Co. is developing electric power for Amherst, Moncton, and other eastern cities. The equipment is being installed by the Canadian Westinghouse Co.

The Detroit Trolley Wheel & Electric Equipment Co., have purchased the Ward factory building in Leamington, Ont., and will manufacture automobiles, brass goods, tools, etc.

The Smith's Falls Malleable Castings Co., of which W. H. Frost is the head, has purchased the Rideau Malleable & Foundry Co., and the two concerns will be amalgamated.

The Stanley Smelting Works, whose mines and plant are located at Bannockburn, Ont., are disposing of stock worth $500,000 to increase the producing capacity of their works.

The Phillip Carey Mfg. Co., Lockland, Ohio, is preparing to erect an asbestos plant at Montreal. It cost $15,000 in duty last year to bring this company's goods into Canada.

The Roxton Mill & Chair Manufacturing Co., Roxton Falls, Que., has dissolved. J. H. Poirier, J. A. Beaudry, Louis Plouffe and Alfred Langevin have taken over the business.

The Canadian Westinghouse Co., of Hamilton, Ont, have secured a quarter of a million dollar contract for electrical machinery and equipment for the Montreal Power & Light Co.

Work has been commenced on the Canadian Iron & Foundry Co's foundry at Fort William, Ont. Railway car wheels, castings and cast iron water and gas pipes, will be manufactured.

The Bank of Nova Scotia has purchased the corner of Portage avenue and Garry street, opposite the Free Press, Winnipeg, for $125,000, and will erect a $200,000 office building.

Arrangements have practically been completed by Henry Coates, of Coates Bros., the English thread manufacturers, to establish a carpet factory at Peterboro with head offices in Toronto.

Fire at Summerside, P.E.I., on Oct. 10 caused loss to the amount of $200,000, with insurance of $50,000. The electric light station and the railway sheds were among the buildings burned.

F. H. Clergue's type of ore-roasting furnace is alleged to be an infringement on the patent furnace of Francis Herreshoff, of New York, chemist, and brother of the famous yacht designers.

The Morgan Cement Works, Montreal, Que., have been purchased by a syndicate of New York and Montreal capitalists who will establish a plant with a capacity of 1,200,000 barrels annually.

The Town of Carberry, Man., is installing in their pumping station a compound duplex pumping engine. The latter is at present being built in the works of the Smart-Turner Machine Co., Hamilton.

Extensions amounting to $175,000 to the plant of the American Locomotive & Machine Co., at Longue Pointe, Que., will add 500 men to the works, and will give a capacity of five locomotives per week.

The Dominion Iron & Steel Co. during August produced 4,947 tons of wire rods, 17,840 tons of steel rails, 25,079 tons of steel ingots, and 20,844 tons of pig iron. The bounty earned would be $70,000.

The Lac Du Bonnet power plant of the Winnipeg Electric Co. has been shut down for want of water and it is feared the plant will be a total failure. It was installed this Summer at a cost of $4,250,000.

For the first time since the commencement of the decline of the bicycle business, the annual report of the Canada Cycle & Motor Company shows an increase in sales over those of the previous year.

Automatic feed pumps and receivers are being supplied by the Smart-Turner Machine Co., Hamilton, to McMaster University, Toronto, the Foster Pottery Co., Hamilton, and John Bertram & Sons, Dundas, Ont.

The Monarch Lumber Co., Savona, B.C., are erecting a new saw mill and planing mill. The saw mill building is 30x144 feet, and the planing mill building 30x60 feet. The capacity of the mill will be 40,000 feet per day.

The first cargo of lumber to leave British Columbia ports for Valparaiso, owing to the recent earthquake in the South American port, is now being loaded in the British ship Curzon, at the Fraser River Saw Mills.

The Hall Elevator & Grain Co., of Vancouver, are letting contracts for a flour mill with a capacity of 500 barrels per day. It is the intention of this company to develop the grain and flour business of the Orient from Vancouver.

The Polson Iron Works, Toronto, are planning a large addition to their works. The proposed site is 132x660 feet. The new building is for casting purposes, and would mean the employment of 100 more men by the company.

Commissioner of Industries Thompson has been successful in securing another industry for Toronto. The United Zinc Co., of Boston, will establish works on Adelaide street, near York street, and will employ about twenty men.

The Maritime Coal Co. will establish an electrical plant at their coal mines near Amherst, N.S. The electric current will be carried to Amherst on a high tension wire and in a short time will be carried on to Moncton a distance of 50 miles.

The International Portland Cement Co., of Hull, will double its present

plant in that city, giving it a capacity of 4,000 barrels daily. They are also completing a mill in Exshaw, Alta., which will make their total daily output 6,500 barrels.

By June, 1907, the Canadian Iron & Foundry Co., Fort William, expect to be employing over 200 men in the manufacture of railway car wheels and castings. Besides the foundry the plans include a machine shop, where marine engines will be built.

Extensions under way at the plant of the American Locomotive & Machine Company at Longue Pointe, Que., will cost $175,000, and will enlarge the works to provide for an additional force of 500 men. The capacity will then be five locomotives per week.

A meeting of shareholders has been called for Oct. 23 to consider the proposed amalgamation of the Robb Engineering Co., of Amherst, N.S., and the Robb, Mumford Boiler Co., of South Framingham, Mass. D. W. Robb is managing director of both concerns.

The Canada Forge Co. have been incorpoarted with a capital of $100,000 to manufacture steel and iron forgings. The directors are: T. J. Dillon, J. T. Dillon, C. Burgess, E. O. Emerson and J. L. Emerson, all of Titusville, Penn. The head office will be at Welland, Ont.

The Kindel Bed Co. have been incorporated with a capital of $15,000 to carry on their usual business. The directors are: C. J. Kindel, J. M. Kindel, D. Robertson, R. Coopersmith, all of New York, and J. W. Abbott, of Toronto. The head office will be at Toronto.

I. E. Shantz & Company's foundry, of Berlin, Ont., was in danger of being destroyed by fire on Wednesday last, but the efforts of the fire department prevented the flames from spreading to the main building. The molding shop suffered loss of $2,000, covered by insurance.

Work is now progressing on the establishment of a large plant for the treatment of ores mined at the Bogart pyrite property near Tweed. Sixty men are now at work and the number will be increased to 200 shortly. A C.P.R. siding is being constructed to the mine.

Whalen & Boweman, who have signed an agreement with the Town of Fort William to build a $50,000 dry dock and ship-repairing yard, are said to be contemplating the establishment there of a $250,000 ship-building plant instead of merely carrying out their first intention.

The annual statement of the Lake Superior Corporation for the year ending June 30, 1906, shows that the company has during that time earned 1 per cent. on its total capital of $10,000,000, which is considered to be a very favorable report when compared with previous years.

Bisset & Loucks, Winnipeg agents for the Caledonian Iron Works, of Montreal, have been awarded the contract to supply the city of Winnipeg with two turbine pumps at a cost of $21,063. The first pump is to be delivered within four months and the second not more than two weeks later.

A despatch from Amherst states that negotiations are under way that will look to the amalgamation of the Robb Engineering Co., of Amherst, and the Robb-Mumford Boiler Company, of South Framingham, Mass. D. W. Robb, of Amherst, is managing director of both companies.

The Canadian Northern Railway Company are asking Toronto for land in Ashbridge's Bay as a site for blast furnaces, which they intend to erect in the near future in conjunction with the entrance of their railway into the city. The company require at least fifty acres of land for their enterprise.

The Lehigh Portland Cement Co. have been incorporated with a capital of $1,000,000 as manufacturers and dealers in cement, lime, whitening and builders' supplies. The directors are: H. C. Tryler, E. M Young, C. A. Matcham, and G. G. Sykes, all of Allentown, Penn. The head office will be at Thurlow, Ont.

The Canada Foundry Co., of Toronto, has been awarded a large portion of a 20,000-ton contract for structural steel by the C.P.R. The steel is for bridges in Ontario. The Dominion Bridge Co. also secured a part of the contract. The Canada Foundry Co. bested bids of a number of large American companies.

Plans have been prepared and ground will soon be broken for the new radiator plant to be established in Toronto by the Warden King and Cluff Bros.' interests. A splendid site has been secured in the northwestern part of the city with good railway shipping facilities, and by next Fall the plant will be in running order.

Messrs. R. Arbuthnot and John C. Marvin, of Winnipeg, are now owners of the Nanaimo Lumber Co.'s plant at the coal city. The deal was put through this week, the purchase price being $125,000 and over. Mr. Arbuthnot, one of the purchasers, has large lumber interests in Manitoba, where he has a retail yard in Winnipeg.

The first electric or trolley locomotives to be used on the Canadian Pacific, or in Canada, will be installed in the Fort William switching yards of the C.P.R. Mr. Cross, assistant to the vice-president, stated that as soon as Kakabeka Falls power plant is completed electricity will be used for motive power in the Fort William yards.

There is at present great rivalry between the various electrical companies at Welland to supply electric power to the industries located there, the Welland Iron Works, M. Beatty & Son, the Robertson Machine Co., Heslop's Roller Mills, Plymouth Cordage Co., Ontario Iron & Steel Co., Automobile Co., Supreme Heater Co., and the Forging Co.

W. I. Kemp, Newark Valley, N.Y., proposes to reopen the Kemp Manure spreading factory in Stratford, as an agricultural machinery factory. The city council is asked to submit a by-law to the ratepayers to guarantee the bonds of the company for the sum of $25,000, repayable in 20 years, and to fix the business assessment at the sum of $25,000 for ten years. The factory was built five years ago at a cost of $36,000.

At Portage la Prairie on Sept. 20, 54,674 tons of eighty-pound steel rails, valued at $1,500,000, were officially entered into Canada from Buffalo. The steel is for use on the Grand Trunk Pacific line, and will be brought to the yards they have established here for distribution. This is said to be the largest single entry ever passed in the west.

The Century Telephone Construction Co. are locating their Canadian factory at 53-59 Adelaide street west, Toronto, where everything used in construction of independent telephone systems will be manufactured. They are at present in the market for cross-arms, toppins, side blocks, glass insulators, and galvanized telephone hardware, and insulated hardware in carload lots.

Dartmouth, N.S., has awarded the contract to the Canadian Fairbanks Co., Limited, for their complete lighting plant for the town, consisting of a 150 h.p. Fairbanks-Morse suction gas producer plant and a 10 k.w. alternator to be belt driven. The Canadian Fairbanks Co. will make the complete installation consisting of the producer engine, alternator, switchboard, etc.

The Montreal Steel Works are increasing their capital from $1,500,000 to $2,000,000. Half of this increased amount, $250,000, will be spent during 1907 in increasing their plant. Arrangements will be made to turn out manganese steel castings in considerable quantities, a special section of the foundry being provided for this purpose. The machine shop and assembling floors will also be largely increased.

The Canadian Westinghouse Co. claim to have abolished the fire engine with the Westinghouse-McDougal turbine pumps, now being installed by the City of Toronto. They have a capacity of 5,000,000 gallons of water every 24 hours, are always ready to work—the steam is always up—and when fire occurs it is only necessary to couple the hose to the fire plug and the water pours out.

A remarkable showing was made this year in municipal ownership by the Port Arthur council. Although a great deal of public work was done, incidental to the growing municipality, the earnings of the various franchises have been so great that the council is able to strike a general rate of nine mills on the dollar. The net earnings of the street railway, light plants, telephone and water system were sufficient to take care of the total debenture debt.

Thomas S. Baker, general manager of the Ontario Steel Ware, Limited, Toronto, has returned from a trip through the Eastern States. While away he visited the largest enamelware plants in order to secure the latest ideas in kitchen ware. Work on the enlargement of their plant on Brock avenue, Toronto, is rapidly proceeding and the company will in another month be able to fill large orders for their new wares.

The Grand Trunk Railway have placed an order with the Locomotive & Machine Company of Montreal for fifty-five new

Richmond compound consolidation engines, to be in service on different divisions of the system before January 1 next. They are powerful machines, as large as any on the continent, except those used in the heavy mountain service, and are 40,000 pounds heavier than the compound freight engines that have been used as standard on the Grand Trunk in the past.

A soap works, a pipe works, and a glass works are the industries to be established in New Westminster very soon, according to report. The soap works is to be built by a capitalist from the east who visited the Coast during the recent exhibition. The pipe works is being founded by local men backed by foreign enterprise. The glass concern may be a reality very soon, as the deal for the property, including buildings already erected, may be completed at any moment.

Good progress is being made in the erection of the addition to the foundry department of the Nelson Iron Works, Nelson, B.C. When the building is completed it will give 5,000 square feet more floor space. Messrs. Isaac & Hinton will increase the capacity of the plant with a new 60-inch cupola, which, with the 30 and 48 inch cupolas now in operation will give a combined capacity for the casting of any size up to eight and ten ton, sufficiently large for any work that may be needed in that section of the province.

The Silsby Lumber Co., of West Burke, Vt., are putting up a large saw mill on their extensive limits recently acquired near St. George de Beauce, Que. The steam plant, consisting of a 350 h.p. duplex saw mill engine, three 125 h.p. high pressure tubular boilers for Dutch oven setting, 100 h.p. feed water heater and 7½x5½x10 duplex boiler feed pump, is being furnished complete by the Jenckes Machine Co., Limited, the boilers being built at their St. Catharines works, and the balance of the plant at Sherbrooke.

J. W. Lyon, of Guelph, secretary-treasurer of the Western Ontario Municipalities Power Association, has a flattering report to make in reference to the canvas made to ascertain the amount of power required by the various places in the Toronto district. The following are the applications so far sent in for power: Toronto, 30,000 horse-power; London, 10,000; Woodstock, 1,200; Paris, 1,000; Galt, 2,500; Preston, 800; Hespeler, 760; Berlin, 3,000; Guelph, 2,000; Waterloo, 900; Stratford, 2,000, and Brantford, 3,000.

The Montreal Smelting & Refining Co. which is building an extensive customs smelter at Trout Lake, near North Bay, Ont., for treatment of Cobalt ores, has closed a contract with the Jenckes Machine Co., Limited, Toronto, for the complete steam plant which will be required. This will consist of four 150 h.p. high pressure tubular boilers, two 250 h.p. heavy duty Corliss engines with feed water heater and boiler feed pump. The boilers are being built at the St. Catharines works of the Jenckes Company and the balance at Sherbrooke.

At the annual meeting of the Quebec Bridge Co., held at Quebec recently, the engineers' report was submitted showing the substantial progress in the work of building the new bridge across the St. Lawrence. On the south side the erection to date extends from the shore abutment to a distance of 900 feet, the quantity of metal put in place being 11,300 tons. In addition to this there are 20,700 tons manufactured and in storage. The manufacture of metal for the bridge is expected to be finished by May next. Hon. S. N. Parent was re-elected president.

While the reports from the subsidiary companies of the United States Steel Corporation have not yet been received at the headquarters of the corporation, steel manufacturers estimate the earnings for the quarter ended September 30 at between $39,000,000 and $40,000,000. One steel representative figures they will be around $39,500,000, or about $600,000 lower than they were in the second quarter of the year. The slight falling off in the third quarter is due, as generally known, to the hot weather, which always retards the operations of the steel mills and furnaces.

The Canada Forge Co. have begun the construction of their buildings at Welland, the contractors being the Welland Construction Co., who also have the construction for the buildings for the Ontario Iron & Steel Co., having been working on them for some time. The Forge Co. will construct two buildings about 50 x 100 feet each, to be completed by November 15; other buildings will be added. They will begin manufacturing early in January. Electrical power will be installed at once, using about 75 horsepower. The capital of the company is $100,000.

Owing to scarcity of water at certain seasons of the year interfering with operations, the Edson Fitch Co., of Etchemin Bridge, Que., a branch of the Diamond Match Co., are installing an auxiliary steam plant, for which the order was recently placed with the Jenckes Machine Co., Limited, of Sherbrooke, Que. It will consist of two 100 h.p. high pressure tubular boilers for Dutch oven setting, 150 h.p. engine, 200 h.p. feed water heater, and 6x4x6 boiler feed pump. The improvements are in charge of Mr. Wright, of Liverpool branch of the Diamond Match Co.

The Ontario Wind Engine & Pump Co., Toronto are about to ship to Cairo, Egypt, two 16ft. airmotor outfits complete with irrigation pumps. This order follows a large one shipped a few weeks ago. It is interesting to note that Canadians are pushing their wares even to the land of the Pharaoh. This company are also making a good exhibit in New Zealand, which will still tend to spread the virtue of Canadian goods. They also received lately an order for a 40ft. "Halladay" windmill (largest size made in wooden wheels) for shipment to Chili, South America, via England.

It is said that the Dominion Iron & Steel Co. have secured a large order from the United States for overhead rails of 125 pounds. They received the sample rail a few days ago. The mill is working now on the G. T. P. contract for 30,000 tons. and it is understood the manufacture of this rail will be begun as soon as this order is finished. The mill is rushed day and night. Very little work is being done in the rod mill of the company, owing to the serious depression in the market. It is stated that strong pressure will be brought to bear upon the Government to increase the duty on wire goods.

The first gasoline traction engine for threshing, plowing and general heavy work, ever built in Canada was turned out of the Dyment Foundry Co's shops at Barrie for its trial trip. The engine weighs four tons and is the invention of J. C. McLachlan, of Toronto, now superintendent of the motor shops. It is equipped with a 40 h.p. double opposed engine and with a gang of ten plows will plow 40 acres a day. The machine is much lighter than a steam engine, and the elimination of the chances of fire is one of the engine's chief recommendations. It will drag a threshing outfit two miles an hour on ordinary roads.

The United States Steel Corporation is forced to the constant expenditure of millions of dollars in order to keep pace with its business. On October 1 the Steel Corporation had, in all, 94 completed furnaces, of which all but seven were in operation. Notwithstanding the fact that it now has practically 97 per cent. of its active blast furnace capacity blowing, it will erect four large blast furnaces in the Pittsburg district at once. Six other furnaces now are in course of erection, four at Gary, Ind., the new $75,000,000 steel town, by the Indiana Steel Co., with a capacity of 600,000 tons, and two at Rankin, Pa., with an annual capacity of about 430,000 tons. All these furnaces will make a specialty of pig iron.

The corporation of Port Arthur, Ont., have placed contracts for an important extension to the municipal hydro-electric plant. The water-wheel portion of the equipment will consist of a pair of 30-inch special Crocker turbines arranged in horizontal steel case, discharging centrally, and developing 1,300 h.p. at 450 revolutions per minute under 85-foot working head, the runners being of bronze. For government there will be a type "C" Woodward water-wheel governor. The contract for the turbines was placed with the Jenckes Machine Co., Limited, Toronto, which company also built the two turbine plants already embraced in the Port Arthur municipal plant. The turbine unit will be direct connected to an Allis-Chalmers-Bullock generator.

Canadian failures for nine months, as reported to Bradstreet's, number 901, involving $6.803,125 of liabilities, a decrease of 11.6 per cent. in number and of 36.2 per cent. in liabilities from a year ago. Failures, assets and liabilities in Canada in nine months for a period of years past follow:

	Number.	Assets.	Liabilities.
1906	901	$2,983,773	$6,803,125
1905.....	1,020	5,162.992	10.676 595
1904.....	832	3,238,256	7,696,688
1903.....	712	2,887,323	6,274,132
1902.....	851	2,759,989	6,300,413
1901.....	1,041	4,160,670	9,376,495
1900.....	1,002	3,017,784	7,441,667
1899.....	975	3,501,274	8 585,901
1898.....	1,091	3,271.772	7,592.510
1897.....	1.501	4,141,860	10.653.212

The Canadian Pacific Railway Co. have placed an order for 2,000 additional freight cars, bringing the total number now under contract at the Angus shops up to 4,000. An order was issued at the same time for thirty-five additional locomotives, which goes to the Montreal Locomotive Works. The decision was also arrived at by the executive to increase the present locomotive output at the Angus shops from 100 to 150 engines per annum. This means that the company will turn out three finished locomotives per week instead of two as they have hitherto done. The total outlay on the new rolling stock equipment that will be delivered to the company and distributed over the system by July next year will be between $7,000,000 and $8,000,000.

Ten years ago the total assets of Canada's chartered banks amounted to only $320,000,000, while to-day they are over $890,000,000. The liabilities ten years ago were $230,000,000, as against $710,000,000 at the present time. The total deposits ten years ago were only $185,000,000, while now they aggregate $607,000,000. The loans and discounts in 1896 were but $222,000,000, while they now aggregate nearly $665,000,000. The paid-up capital ten years ago was $62,200,000, with a rest or reserve fund of 42 per cent. of this amount. Paid-up capital to-day is $93,000,000, and the reserve fund is 70 per cent. on capital. The circulation of bank notes has more than doubled in ten years, while the banks now hold in specie and legal tender nearly $61,000,000, as against $22,000,000 ten years ago.

Four new industrial concerns propose to locate in Goderich shortly, if their propositions receive the approval of the ratepayers. Two will not be voted on at present, but the most important, perhaps, that of the Goderich Wheel Rigs Co., will come up at once, the by-law being published in the local papers this week. Some of the important features are that the authorized capital of the concern will be $250,000, that they will employ by the end of a year at least one hundred hands, and that this is to be the sole Canadian factory of the concern, and a duplicate of the parent plant, the Lloyd Manufacturing Co., Minneapolis, Minn. The goods manufactured will be baby carriages, express wagons, rattan goods — in fact everything of that nature, practically the only manufacturers of these in Canada at present being the Gendron Co., Toronto. They ask the municipality for a loan of $50,000 repayable in twenty equal annual payments, without interest, and the usual privileges.

Cobalt, the New York Commercial says, is a unique mining camp by its remarkable surface showings and in the high grade character of its ores. No where else in this country can one walk on almost solid silver for hundreds of feet, and few, if any, of the world's mines boast the possession of vein matter running away up in the thousands of dollars to the ton. It is to these sensational features that the camp owes its notoriety, and to the same source that one can trace the present boom in Cobalt shares. Few are the mines that have paid from the grass roots, but this is what Cobalt mines have done. From few of the world's mining properties have the owners been able to quarry outright from the surface carloads of such rich ore. Along with these striking developments there has recently occurred an unprecedented rise in the value of the white metal, due to the large demand for coinage purposes in the Orient. Like all boom camps, it says, a large amount of wild-catting may be looked for.

The three largest Montreal steel companies have all plans completed for large additions to their present plants, that will result in the outlay of over $2,000,000 in the next year. The Montreal Steel Company will increase their capital to $2,000,000 by increasing their preferred stock from $700,000 to $1,050,000, and the common stock from $700,000 to $950,000. The company, according to the official announcement, intend to erect a large plant for the manufacture of manganese castings for intersection of street railway and steam railway tracks, and a large power plant and extensions to most of the present works. The plant will be 400 by 300 feet. The Montreal Rolling Mills will erect a large nut and bolt plant, and a large forging mill and new stores department. The Peck Rolling Mills Co. will remove a large portion of their plant from Mill street to the bank of the Lachine Canal, where they intend erecting a large group of mills for the manufacture of nails and smaller kinds of steel. All these companies say they have never been so rushed with orders as at present.

It looks very much as if the C.P.R. were preparing for its campaign of development of Vancouver Island. A survey party is now en route to the west coast of the island, starting from Comox and going across to Alberni Canal. The branch proposed to be built across to Alberni would be only part of the plans of the railway, as an extension of the E. & N. (the island railway now owned by the C.P.R.) from Nanaimo, its present terminus, to Comox is included. The fact that the survey party was sent out just at the time of the visit of President Shaughnessy is considered significant. On the west coast there is considerable development in the vicinity of Alberni Canal, but across the island there will be miles of untrod forest to explore. When the size of Vancouver Island, 250 miles long by 100 broad in some places, is considered, and the facts taken in that it is heavily wooded with magnificent forests of fir and cedar as well as being mountainous in the interior, it will not be surprising that this survey party will have much exploratory work to do, in places where no white man ever yet set foot.

Moving to Hespeler.

The McEachren Heating & Ventilating Co., of Galt, have been granted a loan by the municipality of Hespeler and have already undertaken the erection of large factory buildings in that town. The McEachren Co. has increased in strength very considerably recently and propose carrying on business on a much more extensive scale. By Spring it is anticipated that the new plant in Hespeler will be ready for operation. In the meantime operations will be carried on in their own plant in Galt.

A Large Increase in Business.

An increase in the capital stock of Allis-Chalmers-Bullock, Limited, was agreed upon at the annual meeting, the advance being from $1,200,000 to $2,500,000. Report showed the business had more than doubled during the last year and the number of men working in the shops had been increased from 300 to 600. While Allis-Chalmers-Bullock, Limited, has the right to sell the well known products of the allied companies, Allis-Chalmers Company, Milwaukee, Wis.; Bullock Electric Manufacturing Company, Cincinnati, Ohio; Ingersoll-Sergeant Drill Company, New York, N.Y., and Lidgerwood Manufacturing Company, New York, N.Y., it is the policy of the directors to build the different lines in Canada as soon as the markets warrant it. Though the company has the benefit of the engineering skill of the older companies in the United States, it has its own staff of engineers to superintend construction and modify any of the details which local conditions may require. It will now go thoroughly into the development of two more important lines, hydro-electric machinery and the Christensen air brake.

Allis-Chalmers-Bullock, Limited, is the only company in Canada which manufactures both water turbines and electric generators, and which therefore is thoroughly familiar with the requirements for their successful operation as one unit. The reports of the Ontario Government Hydro-Electric Commission have so stimulated public interest in the subject that, with the present facilities, the company is unable to meet the demand. A portion of the increased capital will therefore be devoted to this work.

The following directors were elected at the meeting: Messrs. Edgar McDougall, W. C. McIntyre, J. W. Pyke, Phelps Johnson, Wm. McMaster, H. J. Fuller, Alex. Pringle and J. A. Milne, of Montreal; W. H. Whiteside and Chas. Allis, of Milwaukee; George Bullock and J. S. Neave, of Cincinnati; E. D. Adams and W. W. Nichols, of New York, and Lloyd Harris, of Brantford. Subsequently, Mr. George Bullock was elected president, and Mr. Edgar McDougall vice-president of the company and chairman of the executive. The directors have had under consideration for some time plans for enlarging the buildings and increasing the equipment and with this increased capital they will be able to go ahead with the contracts for these purposes.

* * *

Sudden Death.

News of the sudden death of Mr. W. T. Jennings in Michigan, an eminent civil engineer of Toronto, came as a shock to the entire engineer fraternity in Canada. Mr. Jennings was one of the best known of Canadian civil engineers, being a past president of the Canadian Society of Civil Engineers. At the time of his death Mr. Jennings was consulting engineer, in which he had a large practice, being chief consulting engineer for the Electrical Development Company and the Toronto-Niagara Power Co. In many instances he had been detained by the Dominion Government to make reports on various engineering enterprises, and was considered one of the most highly qualified men in his line.

New Branch Office.

The Jeffrey Manufacturing Co., engineers, founders and machinists, manufacturers of chain belting, elevating, converting, crushing, screening and power transmission machinery, head office Columbus, O., have opened commodious sales rooms and offices in Montreal, which will be their headquarters for the Dominion. Mr. A. G. Walker, formerly with Williams & Wilson, is in charge of the new business. Mr. Walker was for 15 years with the Williams & Wilson Company, and during these years Williams & Wilson were the agents for the Jeffrey Co., so that the business in all its details has been well mastered by Mr. Walker. Few men in this connection have such an excellent grasp of the machinery and kindred interests in Canada. A stock of standard material such as chain sprockets, buckets, adjustable take-ups, pillow blocks, collars, spiral conveyors, elevator boots, etc. Of any of these estimates, plans, information and prices will be furnished all prospective buyers on application. Twenty-five years experience in these lines enable the firm to furnish labor-saving appliances of the most efficient construction. A large and handsome catalogue with 370 pages has just been received from the printers and will be mailed to those desirous of investigating the lines of the Jeffrey Manufacturing Co.

* * *

Bureau of Testing and Inspection.

The inspection bureau and testing laboratory, recently established by Plews & Trimingham, covers plans, supervisions and specifications as well as tests and investigations. This firm is to be congratulated on their energy in this direction. It is the first time an attempt has been made in Canada to establish such a laboratory, and the effort is bound to meet with the success it merits. The reports of this firm are accepted by the Canadian Fire Underwriters, hence any manufacturer having his apparatus tested and reported favorably upon is sure of its standing and acceptance under all conditions. A large number of firms have already taken up the matter with this company and are having all their various lines of electrical apparatus tested in a thoroughly scientific manner, thus avoiding any possibility of faulty work being sent out. The fact that Canadians have now available an institution of this kind will be of great benefit, particularly to the manufacturing interests. This scheme is assured of success and of a favorable reception at the hands of the Canadian public.

* * *

Collingwood Steel Plant Running.

Men have been at work for several weeks fitting up the Northern Iron & Steel Company's plant at Collingwood, and the president, Major Currie, announced recently that the first bar would be rolled on September 27. An invitation was extended to all Collingwood citizens to be present and three hundred of the leading citizens of the town and surrounding country were present at the mills and witnessed the mill put in operation. The first bar, six by one inch in size, was cut up into souvenirs. The machinery worked to entire satisfaction and the officers of the company received the congratulations of all present. There is a large tonnage on the books for the mills and shipments of finished products commenced this week. The starting of the steel plant will mean a good deal to the wire company, whose plant adjoins. When the steel plant commences furnishing rods to the wire company it will mean a saving in freight to the latter company of over $100 per day. The wire company has been running on orders night and day and is booked up for the remainder of the season.

* * *

Ship Building Industry.

The big 500-foot freighter now under construction at the shipyard, is certainly a wonder for size and strength. Stood on end she would reach as high as a ten-storey building, and to climb to her deck is like going up the winding stairs of the tower at Ottawa. All the framework of this vessel is in position, and the greater portion of the heavy plates also riveted in place. The foundry and machine shops have a large gang busy on the engines for No. 9.

The shipyard is bound to be a money maker. The old conditions have passed away. The company have already a large number of applications for reservation for the Winter months, and it looks as if the dock and yards will be run wide open all Winter with repair work.

Our reporter visited the Northern Iron & Steel Co's works on Monday last, and found this magnificent plant last, and found this magnificent plant The rolling mills will be ready by the end of the month.

About four thousand tons of raw material have already been assembled on the premises, and orders have been booked for the whole of the product manufactured during the first three months.—Collingwood Express.

* * *

New Power Development.

The Maine & New Brunswick Electrical Power Co., which is developing a water power at Aroostook Falls, New Brunswick, has awarded contracts for the necessary equipment. The turbine plant will be built by the Jenckes Machine Co., Limited, Sherbrooke, Que., and will be composed of two 900 h.p. units each consisting of a pair of special 21-inch cylinder gate Crocker turbines, each pair mounted on a cast iron draft tube discharging centrally, set in concrete flume and running 600 h.p.m. under 72-foot head, developing 80 per cent. efficiency at full gate. The turbine runners are cast bronze and the construction throughout is of the most substantial character. One Lombard type "P" water wheel governor will be attached to each unit. A steel penstock 6 feet 6 inches in diameter by 75 feet long conveys the water from forebay to each unit. Each unit will be direct connected to a generator, the order for which was placed with the General Electric Co., Schenectady, New York. The headquarters of the Maine & New Brunswick Power Co. are at Presque Isle, Maine, and the order for the turbine plant was placed in Canada only after the most thorough investigation and comparisons with the product of American turbine makers who were tendering.

Pacific Pipe Co's Progress.

In Eastern Canada the extent of the trade in wooden pipe in British Columbia is hardly realized, and the enormous business being done in this direction within the short time from the organization gives some idea of the scope for future business. The Pacific Pipe Co., of Vancouver, have just completed the manufacture of 10,000 feet of 18-inch pipe for Fort William, Ont., as well as ten miles of 8-inch pipe for the same municipality. The company are now engaged on an order of 10½ miles of pipe to stand a pressure of from 300 to 500 feet head for the Canadian Pacific Railway in Alberta. This is the biggest pipe contract ever given in Canada. They are also working on an order of 6,500,000 of 24-inch pipe for the White Valley Irrigation & Power Co., at Vernon, B.C., as well as an order of about two miles of 6-inch pipe for Port Arthur. Besides these the firm has just completed installing waterworks systems for Cardston and Claresholm.

* * *

Demand for Wooden Pipe.

The Canadian Pipe Co., of Vancouver, have supplied half a million feet of wooden pipe to different points in Canada. The City of Vancouver is installing 3 miles of 36-inch continuous stave pipe built by this company. The pressure from a head of 195 feet is 80 lbs. per square inch. This is for the intake of the city water supply, it having been decided to go three miles further up the mountains to get a better pressure.

* * *

Smelting Ore in Toronto.

It is anticipated in the near future that Moose Mountain ore will be smelted at Toronto, where a proposition has been made for the utilization of a large tract of land at Ashbridge's Bay as a site for blast furnace and steel works. Mackenzie & Mann interests are at the bottom of this to afford an outlet for the extensive ores at Moose Mountain, in Northern Ontario. A furnace of 200 tons daily capacity is considered and it is expected that this will be in operation two years hence. The ore haul will be slightly less than 300 miles, and it is believed Toronto is ideally situated for this on account of its boat transportation facilities both east and west.

* * *

Another Cement Industry.

A syndicate of Montreal and New York capitalists who were forming a strong combine for the manufacture of cement, have purchased the Morgan Cement Works, situated on the outskirts of Montreal. It is proposed to immediately break ground for a plant which will have an initial yearly capacity of 600,000 barrels, with proposed extensions to make the output eventually 1,200,000 barrels. It is proposed to go ahead with the works and have them in running order.

* * *

Removal of Sales Office.

The Ontario sales office of the Jenckes Machine Co., Limited, has been moved from 12 Lawlor building, Toronto, to St. Catharines, Ont., where it will in future be operated in conjunction with the extensive branch works of the company there. Mr. W. G. Chater, as formerly, will be in charge.

"Galvanizing" With Zinc Aluminium Alloy.

In order to get a "galvanizing" bath that shall be quite liquid and yield a brighter surface than is attainable by the use of zinc alone, Guhrs uses an alloy composed of about one-half of one per cent. of aluminium, and one-fifth per cent. of bismuth with the zinc. In order to get this alloy in proper state of diffusion it is necessary to melt the aluminium at the same time with the zinc; the bismuth can be melted in at the same time if desired. It is claimed that simultaneous melting of the zinc and the aluminium prevents the formation of oxide and of hard dross. In order to effect this desirable simultaneous melting of these two metals, it is best to prepare beforehand an alloy of zinc and aluminium, or of these with bismuth, in stronger proportions of aluminium than is desired in the bath—for instance, 20 parts of aluminium and the same of zinc, with five of bismuth, well stirred while melting. This "mix" is to be melted with the rest of the zinc, in such proportions as will give to the resulting melted mass the requisite proportions for the bath.

A higher percentage of aluminium can be used than one-half (one two-hundredths of the entire weight), but it effects no improvement above that brought about by the use of the smaller quantity. The bismuth may be used in even smaller quantities than the above-quoted one-fifth of one per cent.

* * *

Mechanics' Supply Co. Enlarging.

As a result of increased business, the Mechanics' Supply Co., Quebec, are making plans to provide for the future increased trade, and have let contracts for the enlargement of their present commodious and handsome buildings at 80-90 St. Paul street. W. H. Wiggs, the manager of the company, states that two flats 50 x 50 will be added during the coming Winter to the warehouse capacity of his company, and another flat will double their present office space. Mr. Wiggs has every confidence in the growth and development of Quebec as a business centre.

* * *

New Foundry Industry.

On October 8 the first sod of the Canada Iron & Foundry Co.'s new plant was turned by Mr. T. J. Drummond at Fort William, Ont. This marks the commencement of a large and modern foundry where 200 men will be employed. Here will be manufactured railway car wheels and castings, and cast iron water and gas pipes. An up-to-date machine shop equipped with all the latest machinery will be established in connection with the plant and it is expected the works will be running in full blast early in 1907.

* * *

Extending Their Plant.

To accommodate largely increased business in Franklin compressors, the Chicago Pneumatic Tool Co. have found it necessary to still further add to the extensive improvements and additions made this year at their Franklin plant. They are at present adding another 150 feet to their machine shop, which will increase their present capacity from 55 to 70 compressors per month.

* * *

In Their New Factory.

The Kay Electric Dynamo & Motor Co., of Toronto, have lately removed to their new factory and office at 740 Yonge street, Toronto, just south of Bloor. They have added to their already large plant and are prepared to do all kinds of electrical work from the largest to the smallest sizes.

* * *

Canadian Manufacturers.

In many respects the recent convention of the Canadian Manufacturers' Association held in Winnipeg was the most successful in its history. The attendance was much larger than a year ago at Quebec and a vast amount of business of an important nature was disposed of in the businesslike style of the best business men of Canada. It was decided to open a permanent office in London, Eng., to act as a commercial intelligence agency for the association members, to assist in securing skilled labor for the members, and in other ways to promote the interests of the organization. Important steps were also taken in promoting the scheme for the mutual fire insurance of association members.

For the first time in the history of the association the annual convention was held west of the Great Lakes and the event was looked forward to with keen anticipations by the citizens of Western Canada, who, rightly or wrongly, united in considering it a most important epoch in the history of the newer Canada. The west wants manufacturers and is determined to have them, her citizens being thoroughly convinced of the unwisdom of shipping raw materials east and bringing in the manufactured product. The west wants manufacturers and preferably Canadian manufacturers, and hence the keen interest excited by the visit to the west of the Canadian Manufacturers' Association. Winnipeg received them with open arms and everything possible was done to show the visitors the advantages offered them by the metropolis of the west. In the excursion westward which followed the convention the principal western towns have been visited and in all an effort has been made to show the visitors what the west has to offer them. It may be confidently expected that one result of the western visit of the manufacturers will be the establishment in the west of many branch factories and the opening of many more branch warehouses.

The officers elected for the ensuing year were as follows :

President — Harry Cockshutt, of the Cockshutt Plow Co., Brantford.

First Vice-President — Hon. J. D. Rolland, Rolland paper mills, Montreal.

Provincial Vice-Presidents — Ontario : L. Harris, Brantford ; Quebec : G. A. Vandry ; British Columbia: John Hendry, Vancouver ; Manitoba : L. C. McIntyre, Winnipeg ; New Brunswick: Chas. Macdonald, St. John ; Nova Scotia : T. M. Cutler Halifax ; Alberta : A. E. Cross, Calgary ; Saskatchewan : E. J. Brooks, Regina ; Treasurer, Geo. Booth.

COMPANIES INCORPORATED.

Canadian Primelectro Co., Limited, capital $1,000,000, propose to manufacture and deal in electrical machinery and equipment. Head office, Montreal.

The Russel Gas Co. have been incorporated with $5,000 capital, to manufacture gas for light, heat and power purpurposes in the village of Russel, Man.

Pintsch Compressing Co., of the State of New Jersey, licensed to carry on business using the system of Julius Pintsch for lighting cars, steamships or buildings.

The Manitoba Government has granted a charter to the Provincial Contracting Co. to carry on business as builders and contractors. The capital is $150,000, and Winnipeg is the chief place of business.

The Winnipeg & Northern Automobile Co. is incorporated under provincial charter, to carry on a general automobile business. The capital stock is placed at $20,000. Winnipeg will be the chief place of business.

Canada Steam Pump & Machine Co., Limited, share capital $40,000, propose to manufacture pumps and pumping machinery, engines, iron and wood working machinery. Directors, A. H. Eby, T. O. Bard, and A. A. Eby.

The Ontario Iron & Steel Co., Limited, capital $500,000, propose to manufacture, smelt and deal in iron, steel and other metals. Provisional directors, D. Muhlfelder, J. L. Steefel and W. M. German. Head office, Toronto, Ont.

The Ideal Cylinder Snow Plough Co., Limited, capital $100,000, propose to manufacture, sell and deal in snow ploughs. Directors, E. B. Webber, G. Currie, A. H. Hough, M. M. Heiles and A. G. McKay. Head office, Toronto, Ont.

Komnick System Sandstone Brick Machinery Co., Limited, capital $100,000, propose to manufacture and deal in brick making and other machinery. Provisional directors are G. W. Townend, H. L. Douglas and C. Wilkinson, with head office at Toronto.

The Manson Manufacturing Co., Limited, share capital $100,000, propose to manufacture steam engines, boilers, gas engines, gas generators and machinery. Directors are G. J. Manson, S. E. Craig, R. L. Murray, and A. Gunn. Head office, Thorold, Ont.

Welland Electrical Co., Limited, share capital $175,000, propose to purchase, transmit and deal in electric power for lighting. Provisional directors are W. E. Phim, M. McAuliff, W. M. German, R. Cooper, J. H. Crow and C. Henderson ; head office, Welland, Ont.

Scott Machine Co., Limited, capital $40,000, propose to carry on the business of mechanical and electrical engineers and manufacture and deal in machinery. Provisional directors : W. H. Braddon, G. E. Scott, W. C. Scott, E. W. Scott, with head office at London, Ont.

The Standard Gas Holder & Boiler Construction Co., Limited, with share capital of $40,000, propose to manufacture gas holders, boilers, steel tanks, etc. Provisional directors of the com-

pany are L. W. Marsh, W. Henthorn and J. R. Marsh. Head office, Belleville, Ont.

The Saguenay Construction Co., Limited, capital $20,000, propose to carry on a general construction and contracting business with head office at City of Montreal.

The Canadian Electrical & Motor Co., Limited, capital $550,000, propose to deal in and manufacture electric, hydraulic, pneumatic and other machinery. Provisional directors: R. H. Nichols, J. B. Seovell, W. Vandusen, W. A. Johnson and H. A. Drummond. Head office, Toronto.

H. C. Baird, Son & Co., Limited, share capital $100,000, propose to manufacture brick, tile and all other machines, for the manufacture of brick, tile, sewer pipe, etc. Directors are O. Baird, W. J. Mitchell, D. M. McLeod, F. Lindsay and F. J. Hutchins. Head office, Parkhill, Ont.

Canadian Gas Power & Launches, Limited, capital $500,000, propose to manufacture and deal in gasoline, gas, oil and steam engines, motors and motor boats of all kinds. Provisional directors are J. Laishley, W. R. Marshall, Manson Campbell, S. F. McKinnon, D. J. McKinnon, with head office at the City of Toronto.

Barnard-Argue-Roth-Stearns Oil & Gas Co., Limited, with share capital of $100,000, propose to carry on the business of reduction and development company and to operate oil wells. The directors of the company, F. B. Barnard, H. H. Argue, P. W. Roth, J. W. Stearn and A. D. Bissell, with head office at the City of Chatham, Ont.

BETTER THAN THE REVIEW OF REVIEWS.

IT has long been the custom both in this country and England to disparage the attempts of Canadians to produce popular magazines. That the tide has turned is evidenced by the remarks of the editor of one of Ireland's leading periodicals, the Irish Monthly, who asserts that there is in Canada a magazine—The Busy Man's Magazine—which outdistances anything in the same field yet attempted in England. In the course of a long eulogy of this magazine he said: "It seems to realize the ideal that Mr. W. T. Stead proposed to himself better than Mr. Stead himself has done in his Review of Reviews. He, too, proposed to reproduce for busy people the cream of the world's magazines; but he is too original a man, he has too much of his own, to be merely a reproducer. Every page is sure to be studded with Steadisms. His magazine is not the less interesting for that, but it is the less able to give with adequate fullness the best articles of the periodicals of the previous month. The Busy Man's Magazine keeps more steadily—that is the best adverb, and the possible suspicion of a pun must not make us fling it aside—keeps more steadily to its purpose of reproducing for busy men and women the best articles from the current magazines of the world. The form, too, of the magazine is much more pleasant, of a convenient size and shape, and the type large and readable."

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Yearly rate—$2.50 for twenty words or less, 10c a word for each additional word.

The above does not apply to notices under the head of "Machinery Wanted." These notices are inserted free for subscribers.

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SITUATIONS VACANT

WANTED — Capable young man with fair knowledge of mechanics, and good appearance as city traveller in Winnipeg. Good position for right man. Box 57 CANADIAN MACHINERY, 511 Union Bank Building, Winnipeg.

WANTED—By new firm, traveler for engineers' supplies Good salary to experienced man with good connection. Full particulars from Baxter, Paterson & Co., care of CANADIAN MACHINERY Montreal. [10]

HELP Wanted — Lathe, bench and planer hands wanted at once; steady work and good wages to competent men; address stating age, experience, married or single and wages expected. B. F. Barnes Company, Rockford, Ill.

WESTERN REPRESENTATIVE WANTED.

AN agent in the west to handle Beardshaws' "Conqueror" high speed steel and drills, which are meeting with a favorable reception throughout Canada. Alex. Gibb, 13 St. John St., Montreal.

MACHINERY WANTED.

SMOKE consumers are not necessary with producer gas power, because the smoke is turned into gas and used for power; no matter what fuel you use there is absolutely no smoke; write for details or call. W. Gillespie, 98 Front Street, Toronto.

CORBET Foundry and Machine Company, Owen Sound, Ont., make a specialty of marine and stationary engines and boiler repairs; also all kinds of sheet steel work, such as stacks, flumes, hoppers, etc.; write for prices.

TURBINE Water Wheels—The following is another proof that the Canadian turbine is the most economical wheel made:—"Almonte, Ontario, with a pair of 42" Canadian turbines, is practically the only town in the Ottawa valley having an extensive electric plant that was able to run to its full capacity throughout this dry summer, with water to spare." Charles Barber & Sons, Meaford, Ontario.

WANTED—Second-hand gasoline engines; from two to four horse power. Krug Bros. & Co., Chesley.

WANTED — Immediately — Horizontal turbular boiler; six to eight horse power; cash price and minute description necessary. Box 8, Otterville.

FOR SALE

"LITTLE GIANT" turbine water wheels, machine-cut wood and iron tooth gearing; power transmission machinery orders executed with despatch; get catalogue and prices. J. C. Wilson & Co., Glenora, Ont.

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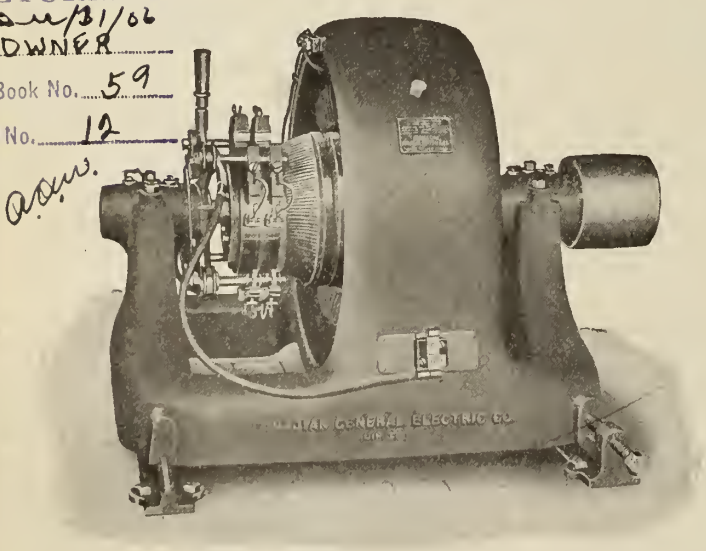

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Canada Machinery Exchange, Montreal.
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Boring Machine, Upright.

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Boring Machine, Wood.

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Boring and Turning Mills.

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Warner & Swasey Co., Cleveland, Ohio.

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Chemists, Metallurgical.

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Detroit Testing Laboratory, Detroit, Mich.

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American Tool Works Co., Cincinnati.
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Chucking Machines.

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Chicago Pneumatic Tool Co., Chicago.
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The Smart-Turner Mach. Co., Hamilton.

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Expanded Metal and Fireproofing Co., Toronto.
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The Smart-Turner Mach. Co., Hamilton.

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Allis-Chalmers-Bullock, Ltd., Montreal.
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Canadian Westinghouse Co., Hamilton.
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Link-Belt Co., Philadelphia.
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Smart-Turner Machine Co., Hamilton.
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Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

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Crank Pin Turning Machine

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Cutters, Flue

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J. W. Paxson Co., Philadelphia, Pa.

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Brown & Sharpe, Providence, R.I.
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London Mach. Tool Co., Hamilton, Ont.
H. W. Petrie, Toronto.
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Pratt & Whitney Co., Hartford, Conn.
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Rice Lewis & Son, Toronto.

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Miller Bros. & Toms, Montreal.
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Niles-Bement-Pond Co., New York.

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Niles-Bement-Pond Co., New York.
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Williams & Wilson, Montreal.

Drilling Machines Connecting Rod.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont
Niles-Bement-Pond Co. New York.

Drilling Machines, Locomotive Frame.

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B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Multiple Spindle.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Bickford Drill & Tool Co., Cincinnati.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Pneumatic

Canada Machinery Agency, Montreal.

Drilling Machines, Portable

Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
H. B. Underwood & Co., Philadelphia.

Drilling Machines, Radial.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Bickford Tool & Drill Co., Cincinnati.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drilling Machines, Suspension.

John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co. New York

Drilling Machines, Turret.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

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American Tool Works Co., Cincinnati.
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Boynton & Plummer, Worcester, Mass.
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The Canadian Fairbanks Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
W. H. Petrie, Toronto.
Williams & Wilson, Montreal.

Drills, Bench.

B. F. Barnes Co., Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Canadian Buffalo Forge Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.

Drills, Blacksmith.

Boynton & Plummer, Worcester, Mass.
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
New Process Twist Drill Co., Taunton, Mass.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg., Co., St. Catharines.

Drills, Centre.

Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
L. S. Starrett Co., Athol, Mass.

Drills, Electric

B. F. Barnes Co,, Rockford, Ill.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drills, Gang.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Pratt & Whitney Co., Hartford, Conn.

Drills, High Speed.

Wm. Abbott, Montreal.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.

New Process Twist Drill Co., Taunton, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Whitman & Barnes Mfg. Co., St. Catharines.

Drills, Hand.

Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.

Drills, Horizontal.

B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drills, Jewelers.

Pendrith Machinery Co., Toronto.

Drills, Pneumatic.

Canada Machinery Agency, Montreal.
Chicago Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.

Drills, Radial.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Drills, Ratchet.

Armstrong Bros. Tool Co., Chicago.
A. B. Jardine & Co., Hespeler,
New Process Twist Drill Co., Taunton, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg., Co., St. Catharines.

Drills, Rock.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Drills, Sensitive.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Canada Machinery Agency Montreal.
Niles-Bement-Pond Co., New York.

Drills, Shop View.

John Bertram & Sons Co., Dundas, Ont.

Drills, Twist.

Chicago Pneumatic Tool Co., Chicago.
Alex. Gibb, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
John Millen & Son, Ltd., Montreal.
Morse Twist Drill and Machine Co., New Bedford, Mass.
New Process Twist Drill Co., Taunton, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

Drying Apparatus of all Kinds.

Canadian Buffalo Forge Co., Montreal.
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Sheldon's Limited, Galt, Ont.
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Dump Cars.

Canada Foundry Co., Limited, Toronto.
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Hamilton Facing Mill Co., Hamilton and Montreal.
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Link-Belt Eng. Co., Philadelphia.
John McDougall Caledonian Iron Works Co., Montreal
Miller Bros. & Toms, Montreal.
Waterous Engine Co., Brantford.

Dust Separators.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.

Dynamos.

Allis-Chalmers-Bullock, Limited, Montreal
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Canadian Westinghouse Co., Hamilton.
D'Olier Engineering Co., New York.
Hall Engineering Works, Montreal, Que.
John Millen & Son, Ltd., Montreal.
Packard Electric Co., St. Catharines.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Dynamos—Turbine Driven.

Kerr-Turbine Co., Wellsville, N.Y.

Economizer, Fuel.

Canadian Buffalo Forge Co., Montreal.
Dominion Henderson Bearings, Limited, Toronto.
McEachren Heating and Ventilating Co., Galt, Ont
B. F. Sturtevant Co., Hyde Park, Man.

Electrical Instruments.

Canadian Westinghouse Co., Hamilton.

Electrical Supplies.

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
London Mach. Tool Co., Hamilton, Ont
John Millen & Son, Ltd., Montreal.
Packard Electric Co., St. Catharines.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Electrically Driven Tools and Machinery.

American Tool Works Co., Cincinnati.
John Bertram & Sons, Dundas.
Canada Machinery Agency, Montreal.
Canadian Westinghouse Co., Hamilton.
Hall Engineering Works Montreal, Que.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Electrical Repairs

Canadian Westinghouse Co., Hamilton.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Emery and Emery Wheels.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton.

Emery Wheel Dressers.

Canada Machinery Agency, Montreal.
Diamond Saw & Stamping Works, Buffalo
Dominion Foundry Supply Co., Montreal and Toronto
Hamilton Facing Mill Co., Hamilton.
John Millen & Son, Ltd., Montreal.
H. W. Petrie, Toronto.
Standard Tool Co., Cleveland.

Emery Wheel Dressers, Cutters.

Diamond Saw & Stamping Works, Buffalo.

Engineers and Contractors.

Canada Foundry Co. Limited, Toronto.
Canadian White Co. Montreal.
D'Olier Engineering Co., New York.
Hall Engineering Works, Montreal, Que.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Link-Belt Co., Philadelphia.
John McDougall Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms Montreal.
The Smart-Turner Mach. Co., Hamilton.

Engineers' Supplies.

Hall Engineering Works, Montreal Que.
Rice Lewis & Son, Toronto.

Engines, Gas and Gasoline.

Canada Machinery Agency Montreal.
The Canadian Fairbanks Co., Montreal.
Canadian McVicker Engine Co., Galt, Ont
Dominion Henderson bearings, Limited, Toronto.
Economic Heat, Light and Power Supply Co., Toronto.
W. Gillespie, Toronto.
The Goldie & McCulloch Co., Galt, Ont.
International Harvester Co., Chicago
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.

Engines, Steam.

Allis-Chalmers-Bullock, Limited, Montreal
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
D'Olier Engineering Co., New York.
The Goldie & McCulloch Co., Galt, Ont.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
John McDougall Caledonian Iron Works Montreal.
Miller Bros. & Toms, Montreal.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.
Waterous Engine Works Co., Brantford.

Engravers.

Toronto Engraving Co., Toronto.

Exhaust Heads.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Expanded Metal.

Expanded Metal and Fireproofing Co. Toronto

Expanders.

A. B. Jardine & Co., Hespeler, Ont.

Fans, Electric.

Canadian Buffalo Forge Co., Montreal.
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Fans, Exhaust.

Canadian Buffalo Forge Co., Montreal.
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Feed Water Heaters.

John McDougall, Caledonian Iron Works Co., Montreal.
The Smart-Turner Mach. Co., Hamilton

Files and Rasps.

John Millen & Son Ltd., Montreal.
Rice Lewis & Son, Toronto.
Nicholson File Co., Providence, R.I.
H. W. Petrie, Toronto.
Whitman & Barnes Mfg. Co., St. Catharines.

Fillet, Pattern.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Fire, Apparatus.

Waterous Engine Works Co., Brantford.

Fire Brick and Clay.

Dominion Foundry Supply Co., Montreal and Toronto
Hamilton Facing Mill Co., Hamilton and Montreal.
J. W. Paxson Co., Philadelphia, Pa.

Flash Lights.

Berlin Electrical Mfg. Co., Berlin, Ont.

Flour Mill Machinery.

Allis-Chalmers-Bullock Co., Montreal.
The Goldie & McCulloch Co., Galt, Ont.
John McDougal, Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms, Montreal.

Flue Rollers.

Chicago Pneumatic Tool Co., Chicago.

Forges.

Boynton & Plummer, Worcester, Mass.
Canada Foundry Co., Limited, Toronto.
Canadian Buffalo Forge Co., Montreal.
Hamilton Facing Mill Co., Hamilton and Montreal.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Forgings, Drop.

John McDougall, Caledonian Iron Works Co., Montreal.
H. W. Petrie, Toronto.
St. Lawrence Supply Co., Montreal.
Whitman & Barnes Mfg. Co., St. Catharines.

Forging Machinery.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio
Niles-Bement-Pond Co., New York.
Western Machine Co., Stouffville, Ont.

Founders.

John McDougall, Caledonian Iron Works Co., Montreal
R. McDougall Co., Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
Western Machine Co., Stouffville, Ont.

Foundry Facings.

J. W. Paxson Co., Philadelphia, Pa.

Friction Clutch Pulleys, etc.

The Dodge Mfg. Co., Toronto.
The Goldie & McCulloch Co., Galt, Ont.
Link-Belt Co., Philadelphia.
W. B. McLean & Co., Montreal.
Miller Bros. & Toms, Montreal.
Sylvester Mfg. Co., Lindsay, Ont.

Furnaces.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Galvanizing

Canada Metal Co., Toronto.

Gas Blowers and Exhausters.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
D'Olier Engineering Co., New York.
B. F. Sturtevant Co., Hyde Park, Man.

Gas Plants, Suction.

Dominion Henderson Bearings, Limited, Toronto.
Economic Heat, Light and Power Supply Co., Toronto.
W. Gillespie, Toronto.
Sylvester Mfg. Co., Lindsay, Ont.
Wayland Williams & Dadson, Montreal.
Western Machine Co., Stouffville, Ont.

Gauges, Standard.

Brown & Sharpe, Providence, R.I.
W. B. McLean & Co., Montreal.
Pratt & Whitney Co., Hartford, Conn.

Gearing.

W. B. McLean & Co., Montreal.

Gear, Cutting Machinery.

Becker-Brainard Milling Mach. Co., Hyde Park, Mass
Bickford Drill & Tool Co., Cincinnati.
Brown & Sharpe, Providence, R.I.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Gears, Angle.

Brown & Sharpe, Providence, R.I.
Chicago Pneumatic Tool Co., Chicago.
Laurie Engine & Machine Co., Montreal.
John McDougall, Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms, Montreal.
Waterous Engine Co., Brantford.

Gears, Reducing.

Brown & Sharpe, Providence, R.I.
Chicago Pneumatic Tool Co., Chicago.
John McDougall, Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms, Montreal.

Generators, Electric.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.
D'Olier Engineering Co., New York.
Hall Engineering Works, Montreal.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Mass.

Generators, Gas.

H. W. Petrie, Toronto.

Glass Bevelling Machines.

Pendrith Machinery Co., Toronto.

Graphite Paints.

P. D. Dods & Co., Montreal.

Graphite.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Grinders, Automatic Knife.

W. H. Banfield & Son, Toronto.

Grinders, Centre.

Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinders, Cutter.

Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Millen & Son, Ltd., Montreal.
Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.

Grinders, Tool.

Armstrong Bros. Tool Co., Chicago.
B. F. Barnes Co., Rockford, Ill.
Brown & Sharpe, Providence, R.I.
H. W. Petrie, Toronto.
The Stevens Co., Galt, Ont.
Williams & Wilson, Montreal.

Grinding Machines.

Brown & Sharpe, Providence, R.I.
The Canadian Fairbanks, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinding and Polishing Machines.

The Canadian Fairbanks Co., Montreal.
Dominion Henderson Bearings, Limited. Toronto.
John Millen & Son, Ltd., Montreal
Miller Bros. & Toms, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pendrith Machinery Co., Toronto.

Hack Saws.

Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Diamond Saw and Stamping Works, Buffalo, N. Y.
John Millen & Son, Ltd., Montreal.
Niles-Bement-Pond Co., New York.
W. B. McLean & Co., Montreal.
H. W. Petrie, Toronto.
West Haven Mfg. Co., New Haven, Conn.
Williams & Wilson, Montreal.

Hack Saw Frames

Diamond Saw and Stamping Works, Buffalo, N.Y.
West Haven Mfg Co., New Haven, Conn.

Hammers, Drop.

London Mach. Tool Co., Hamilton, Ont.
Miller Bros. & Toms Montreal.
Niles-Bement-Pond Co., New York.

Hammers, Rand—All Kinds.

Whitman & Barnes Mfg. Co., St. Catharines.

Hammers, Steam.

John Bertram & Sons Co. Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Hangers.

Dominion Henderson Bearings, Limited, Toronto.
The Goldie & McCulloch Co., Galt, Ont.
Miller Bros. & Toms, Montreal.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford.
Pendrith Machinery Co., Toronto.

Hardware Specialties

Globe Machine & Stamping Co., Cleveland Ohio.

Heating Apparatus.

Canadian Buffalo Forge Co., Montreal
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., High Park, Mass.

Hoisting and Conveying Machinery.

Allis-Chalmers-Bullock, Limited, Montreal
Jenckes Machine Co., Sherbrooke, Que.
Link-Belt Co., Philadelphia.
Miller Bros. & Toms, Montreal.
Niles-Bement-Pond Co., New York.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford,

Hoists, Pneumatic.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co. Chicago.
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Hose, Air.

Canadian Rand Drill Co., Montreal.
Canadian Westinghouse Co., Hamilton.
Chicago Pneumatic Tool Co. Chicago.

Hose Couplings.

Canadian Rand Drill Co., Montreal.
Canadian Westinghouse Co., Hamilton.
Chicago Pneumatic Tool Co., Chicago.
Whitman & Barnes Mfg. Co., St. Catharines.

Hose, Steam.

Allis-Chalmers-Bullock, Ltd., Montreal.
Canadian Rand Drill Co., Montreal.
Canadian Westinghouse Co., Hamilton.

Hydraulic Accumulators.

Niles-Bement-Pond Co., New York.
The Smart-Turner Mach. Co., Hamilton.

Hydraulic Machinery.

Allis-Chalmers-Bullock, Limited, Montreal
John McDougall, Caledonian Iron Works Co., Montreal.
Niles-Bement-Pond Co., New York.

Indicators, Speed.

L. S. Starrett Co., Athol, Mass.

Injectors.

Canada Foundry Co., Toronto.
The Canadian Fairbanks Co., Montreal.
Rice Lewis & Son, Toronto.
Penherthy Injector Co., Windsor, Ont.

Iron Cements.

Hamilton Facing Mill Co., Hamilton and Montreal.

Iron Filler.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Iron Tools.

John Bertram & Sons Co., Dundas, Ont.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
H. W. Petrie, Toronto.
The Stevens Co., Galt, Ont.

Key-Seating Machines.

B. F. Barnes Co., Rockford, Ill.
Niles-Bement-Pond Co., New York.

Lace Leather.

Sadler & Haworth, Montreal.

Lamps, Arc and Incandescent.

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The Packard Electric Co., St. Catharines.

Lathe Dogs.

Armstrong Bros., Chicago
Pratt & Whitney Co., Hartford, Conn.

Lathes, Engine.

American Tool Work Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
R. McDougall Co., Galt, Ont.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.

Lathes, Foot-Power.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.

Lathes, Screw Cutting.

B. F. Barnes Co., Rockford, Ill.
Niles-Bement-Pond Co., New York

Lathes, Automatic, Screw-Threading.

John Bertram & Sons Co., Dundas, Ont
London Mach. Tool Co., Hamilton, Ont
Pratt & Whitney Co., Hartford, Conn.

Lathes, Bench.

B. F. Barnes Co., Rockford, Ill.
London Mach. Tool Co., London, Ont
Pratt & Whitney Co., Hartford, Conn

Lathes, Turret.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
R. McDougall Co., Galt, Ont.
The Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.
Warner & Swasey Co., Cleveland, O.

Lathes, Buffing and Polishing.

Pendrith Machinery Co., Toronto.

Lathes, Metal Spinning.

Pendrith Machinery Co., Toronto.

Leather Belting.

Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal
The Dodge Mfg. Co., Toronto.

Lime Stone Flux.

Hamilton Facing Mill Co., Hamilton and Montreal.

Locomotives, Air.

Canadian Rand Drill Co., Montreal.

Locomotives, Electrical.

Canadian Westinghouse Co., Hamilton

Locomotives, Steam.

Canada Foundry Co., Toronto.
Canadian Rand Drill Co., Montreal

Lubricator, Plumbago.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Lumber Dry Kilns.

Canadian Buffalo Forge Co., Montreal
McEachren Heating and Ventilating Co., Galt, Ont.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Machinery Dealers.

Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Dominion Henderson Bearings, Limited, Toronto.
Miller Bros. & Toms, Montreal.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
St. Lawrence Supply Co., Montreal.
Williams & Wilson Montreal.

Machinery Designers.

Dominion Henderson Bearings, Limited, Toronto.

Machinists.

W. H. Banfield & Sons, Toronto.
The Dodge Mfg. Co., Toronto.
Dominion Henderson Bearings, Limited, Toronto.
Hall Engineering Works, Montreal, Que.
Link-Belt Co., Philadelphia.
John McDougall, Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms, Montreal.
Pendrith Machinery Co., Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford.

Machinists' Small Tools.

Armstrong Bros., Chicago.
Brown & Sharpe, Providence, R.I.
Butterfield & Co., Rock Island, Que.
Diamond Saw and Stamping Works, Buffalo, N. Y.
Rice Lewis & Son, Montreal.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
L. S. Starrett Co., Athol, Mass.
Williams & Wilson, Montreal.

Mailing Weights.

A. B. Jardine & Co., Hespeler, Ont.

Mandrels.

Brown & Sharpe, Providence, R.I.
A. B. Jardine & Co., Hespeler, Ont.
Miller Bros & Toms, Montreal.
The Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg. Co., St. Catharines.

Measuring Machines.

The Pratt & Whitney Co., Hartford, Conn.

Mechanical Draft.

Canadian Buffalo Forge Co., Montreal.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Metallic Paints.

P. D. Dods & Co., Montreal.

Meters, Electrical.

Canadian Westinghouse Co., Hamilton.

Mill Machinery.

The Dodge Mfg. Co., Toronto.
The Goldie & McCulloch Co., Galt, Ont.
Jenckes Machine Co., Sherbrooke, Que.
John McDougall, Caledonian Iron Works Co., Montreal.
H. W. Petrie, Toronto.
Waterous Engine Co., Brantford.
Williams & Wilson, Montreal.

Milling Attachments.

Becker-Brainard Milling Machine Co. Hyde Park, Mass.
John Bertram & Sons Co., Dundas, Ont.
Brown & Sharpe, Providence, R.I.
Niles-Bement-Pond Co., New York,
Pratt & Whitney, Hartford, Conn.
The Stevens Co., Galt, Ont.

Milling Machines, Horizontal.

Becker-Brainard Milling Machine Co., Hyde Park, Mass.
John Bertram & Sons Co., Dundas, Ont.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
Pratt & Whitney, Hartford, Conn.

Milling Machines, Plain.

American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co. Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Milling Machines, Universal.

American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Milling Machines, Vertical.

Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Milling Tools.

Wm. Abbott, Montreal.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
Dominion Henderson Bearings, Limited, Toronto.
Geometric Tool Co., New Haven, Conn.
London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
The Stevens Co., Galt, Ont.

Mining Machinery.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
The Dodge Mfg. Co., Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
John McDougall, Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms, Montreal.
T. & H. Electric Co. Hamilton.

Mixing Machines, Dough.

Pendrith Machinery Co., Toronto.

Mixing Machines, Special.

Pendrith Machinery Co., Toronto.

Model Tools.

Dominion Henderson Bearings, Limited, Toronto.
Globe Machine & Stamping Co., Cleveland, Ohio.
The Stevens Co., Galt, Ont.
Wells Pattern and Model Works, Toronto

Motors, Electric.

Allis-Chalmers-Bullock Limited, Montreal
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Hall Engineering Works, Montreal, Que.
The Packard Electric Co., St. Catharines.
B. F. Sturtevant Co., Hyde Park, Mass.
T. & H. Electric Co., Hamilton.

Motors, Air.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Molders' Supplies.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Molders' Tools.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Molding Machines.

J. W. Paxson Co., Philadelphia, Pa.

Molding Sand.

T. W. Barnes, Hamilton, Ont.
Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Nippers, Stay Bolt.

Chicago Pneumatic Tool Co., Chicago.

Nut Tappers.

John Bertram & Sons Co., Dundas, Ont
A. B. Jardine & Co., Hespeler.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio.

Oatmeal Mill Machinery.

The Goldie & McCulloch Co., Galt

Oils, Core.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.

Painting Machines, Pneumatic.

Chicago Pneumatic Tool Co., Chicago.

Patent Solicitors.

Hanbury A. Budden, Montreal.
Fetherstonhough & Blackmore, Montreal
Fetherstonhaugh & Co., Montreal.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

Patterns.

John Carr, Hamilton.
The Dodge Mfg. Co., Toronto.
Hamilton Pattern Works, Hamilton.
John McDougall, Caledonian Iron Works Co., Montreal
Miller Bros. & Toms Montreal.
The Stevens Co., Galt, Ont.
Wells' Pattern and Model Works, Toronto.

Pipe Cutting and Threading Machines.

Butterfield & Co., Rock Island, Que.
Canada Machinery Agency, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York.

Pipe, Municipal.

Pacific Coast Pipe Co., Vancouver, B.C.

Pipe, Waterworks.

Pacific Coast Pipe Co., Vancouver, B.C

Pipe, Wooden.

Pacific Coast Pipe Co., Vancouver, B.C.

Planers, Portable.

H. B. Underwood Co., Philadelphia.

Planers, Standard.

American Tool Works, Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Planers, Rotary.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Power Hack Saw Machines.

Diamond Saw and Stamping Works, Buffalo, N. Y.

Power Plants.

John McDougall Caledonian Iron Works Co., Montreal
The Smart-Turner Mach. Co., Hamilton

Planing Mill Fans.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Man.

Plug Drillers, Pneumatic.

Canada Foundry Co., Limited, Toronto.
Canadian Rand Drill Co., Montreal.

Plumbago.

Dominion Foundry Supply Co., Montreal and Toronto.
Hamilton Facing Mill Co., Hamilton and Montreal.
J. W. Paxson Co., Philadelphia, Pa.

Pneumatic Tools.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago
Hamilton Facing Mill Co., Hamilton.

Presses, Drill.

American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.

Presses, Drop.

W. H. Banfield & Son, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Canada Machinery Agency, Montreal.
Miller Bros. & Toms, Montreal.
Niles-Bement-Pond Co., New York

Presses, Hand.

E. W. Bliss Co., Brooklyn, N.Y.

Presses, Hydraulic.

Jenckes Machine Co., Sherbrooke, Que.
John Bertram & Sons Co., Dundas, Ont.
Laurie Engine & Machine Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
John McDougall Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms. Montreal.
Niles-Bement-Pond Co., New York.

Presses, Power.

E. W. Bliss Co., Brooklyn, N.Y.
Canada Machinery Agency, Montreal.
Jenckes Machine Co., Sherbrooke, Que.
London Mach. Tool Co., Hamilton, Ont.
John McDougall Caledonian Iron Works Co., Montreal.
Niles-Bement-Pond Co., New York.

Pulp Mill Machinery.

Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
John McDougall Caledonian Iron Works Co., Montreal.

Pulleys.

Canada Machinery Agency, Montreal
The Canadian Fairbanks Co., Montreal.
The Dodge Mfg. Co., Toronto.
Dominion Henderson Bearings, Limited, Toronto.
The Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Link-Belt Co., Philadelphia.
John McDougall Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms, Montreal.
Pendrith Machinery Co., Toronto.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Williams & Wilson, Montreal.
Waterous Engine Co., Brantford.

Pumps, Steam.

Allis-Chalmers-Bullock, Limited, Montreal
Canada Foundry Co., Toronto.
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
D'Olier Engineering Co., New York.
Dominion Henderson Bearings, Limited, Toronto.
The Goldie & McCulloch Co., Galt.
John McDougall Caledonian Iron Works, Montreal.
R. McDougall Co., Galt, Ont.
H. W. Petrie, Toronto.
St. Lawrence Supply Co., Montreal.
The Smart-Turner Mach. Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.
Waterous Engine Co., Brantford.

Pumping Machinery.

Canada Foundry Co., Limited, Toronto
Canada Machinery Ageocy, Montreal.
Canadian Buffalo Forge Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
D'Olier Engineering Co., New York.
Dominion Henderson Bearings, Limited, Toronto.
Hall Engineering Works, Montreal, Que.
Laurie Engine & Machine Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
John McDougall Caledonian Iron Works Co., Montreal.
R. McDougall Co., Galt, Ont.
St. Lawrence Supply Co., Montreal.
The Smart-Turner Mach. Co., Hamilton.

Punches and Dies.

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Butterfield & Co., Rock Island.
Dominion Henderson Bearings, Limited, Toronto.
Globe Machine & Stamping Co.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Miller Bros. & Toms, Montreal.
Pratt & Whitney Co., Hartford, Conn.
H. W. Petrie, Toronto.

Punches, Hand.

Canadian Buffalo Forge Co., Montreal

Punches, Power.

John Bertram & Sons Co., Dundas, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co,, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Punches, Turret.

London Mach. Tool Co., London, Ont.
Taylor & McKenzie, Guelph.

Punching Machines, Horizontal.

John Bertram & Sons Co , Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Quartering Machines.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.

Rapping Plates.

Hamilton Facing Mill Co., Hamilton and Montreal.

Reamers.

Wm. Abbott, Montreal.
Brown & Sharpe, Providence, R.I.
Butterfield & Co., Rock Island.
A. B. Jardine & Co., Hespeler, Ont.
John Millen & Son, Ltd., Montreal.
Morse Twist Drill and Machine Co., New Bedford, Mass
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
The Stevens Co., Galt, Ont.
Whitman & Barnes Mfg. Co., St. Catharines.

Reamers, Steel Taper.

Butterfield & Co., Rock Island.
Chicago Pneumatic Tool Co., Chicago.
A. B. Jardine & Co., Hespeler, Ont.
John Millen & Son, Ltd., Montreal.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Mfg. Co., St. Catharines.

Rheostats.

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Hall Engineering Works Montreal, Que.
T. & H. Electric Co., Hamilton,

Riddles.

J. W. Paxson Co., Philadelphia, Pa.

Riveters, Hydraulic.

London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Rolls, Bending.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Rotary Converters.

Allis-Chalmers-Bullock, Ltd., Montreal.
Canadian Westinghouse Co., Hamilton

Safes.

The Goldie & McCulloch Co., Galt, Ont.

Sand, Bench.

Albany and North River Moulding Sand Co., Albany, N.Y.

Sand Blast Machinery.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Hamilton Facing Mill Co., Hamilton and Montreal.
J. W. Paxson Co., Philadelphia, Pa.

Sand, Brass.

Albany and North River Moulding Sand Co., Albany, N.Y.

Sand, Heavy, Grey Iron.

Albany and North River Moulding Sand Co., Albany, N.Y.

Sand, Malleable.

Albany and North River Moulding Sand Co., Albany, N.Y.

Sand, Medium Grey Iron.

Albany and North River Moulding Sand Co., Albany, N.Y.

Sand, Plate.

Abany and North River Moulding Sand Co., Albany, N.Y

Sand Sifters.

Dominion Foundry Supply Co., Montreal and Toronto
Hamilton Facing Mill Co., Hamilton.

Sand, Stove Pipe.

Albany and North River Moulding Sand Co., Albany, N.Y.

Saw Gummers.

Canada Machinery Agency, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Waterous Engine Co., Brantford.

Saw Machines, Power Hack.

Diamond Saw & Stamping Works, Buffalo.
West Haven Mfg. Co., New Haven, Conn.

Saw Mill Machinery.

Allis-Chalmers-Bullock, Limited, Montreal
Canada Machinery Agency Montreal.
Clark-Demill Co., Hespeler, Ont.
The Dodge Mfg. Co., Toronto.
Dominion Henderson Bearings, Limited, Toronto.
Goldie & McCulloch Co., Galt.
Miller Bros. & Toms, Montreal.
H. W. Petrie, Toronto.
Waterous Engine Works, Brantford.
Williams & Wilson, Montreal.

Sawing Machines, Metal.

Niles-Bement-Pond Co. New York.
West Haven Mfg. Co., New Haven, Conn.

Saws, Hack.

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Diamond Saw & Stamping Works, Buffalo.
London Mach. Tool Co., Hamilton, Ont
Rice Lewis & Son, Toronto.
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Saws, Kitchen.

Diamond Saw & Stamping Works, Buffalo

Saws, Power Hack.

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Screw Cutting Tools

Hart Manufacturing Co., Cleveland, Ohio

Screw Machines, Automatic.

Brown & Sharpe, Providence, R.I.
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London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.

Screw Machines, Hand.

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London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.
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Machinery Exchange, Montreal.
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Sewer Pipe.

Dominion Sewer Pipe Co., Toronto.

Shafting.

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The Dodge Mfg. Co., Toronto.
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Niles-Bement-Pond Co., New York.
Pendrith Machine Co.,Toronto.
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Union Drawn Steel Co., Hamilton.
Waterous Engine Co., Brantford.

Shapers.

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Canada Machinery Agency, Montreal.
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London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
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London Mach. Tool Co., Hamilton, Ont.
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Canadian Buffalo Forge Co., Montreal.

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Canadian Buffalo Forge Co., Montreal.

Shears, Hand.

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Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
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The Stevens Co., Galt, Ont.
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B. K. Morton & Co., Sheffield, Eng.
Williams & Wilson, Montral.

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Hall Engineering Works, Moutreal, Que.
T. & H. Electric Co., Hamilton.

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The Dodge Mfg. Co., Toronto.
Laurie Engine & Machine Co., Montreal.
Link-Belt Co., Philadelphia.
Miller Bros. & Toms, Montreal.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford.

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Miller Bros. & Toms, Montreal
Pendrith Machinery Co., Toronto.
H. W. Petrie, Toronto.

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Miller Bros. & Toms, Montreal.

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Turbines, Steam

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The Stevens Co., Galt, Ont.
Warner & Swasey Co., Cleveland, Ohio.
Williams & Wilson, Montreal.

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American Tool Works Co., Cincinnati, O
A. B. Jardine & Co., Hespeler. Ont.
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Water Power Plants.

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Water Wheels.

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Hamilton Facing Mill Co., Hamilton and Montreal.

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Window Wire Guards.

Expanded Metal and Fireproofing Co Toronto.
B. Greening Wire Co., Hamilton, Ont.

Wire Chains.

The B. Greening Wire Co., Hamilton.

Wire Cloth and Perforated Metals.

Expanded Metal and Fireproofing Co. Toronto.
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Wire Guards and Railings.

Expanded Metal and Fireproofing Co. Toronto.
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Wire Nail Machinery.

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Wire Rope.

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Wood-working Machinery.

Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Clark-Demill Co., Hespeler, Ont.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
St. Lawrence Supply Co., Montreal.
Waterons Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Wrenches, Adjustable Tap.

Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Hespeler Ont.
Standard Tool Co., Cleveland.

Wrenches, Machinists.'

Whitman & Barnes Mfg Co., St. Catharines, Ont.

Wrenches, Ratchet.

Whitman & Barnes Mfg. Co., St. Catharines, Ont.

Wrenches, Universal.

Whitman & Barnes Mfg. Co., St. Catharines, Ont.

ALPHABETICAL INDEX.

A

Abbott, Wm. 83
Albany and North River Moulding sand Co. 77
Allis-Chalmers-Bullock Co. ..... Outside back cover
American Tool Works Co 7
Armstrong Bros. Tool Co. 86

B

Barnes, T. W. 76
Barnes, B. F., Co. 3
Banfield, W. H., & Sons 78
Baxter, Patterson & Co. 85
Becker-Brainard Milling Machine Co. . 2
Berlin Electrical Mfg. Co. 65
Bertram, John, & Sons . ....fron' cover
Bickford Drill & Tool Co. 6
Brandeis, Charles 75
Brown & Sharpe Mfg. Co. 82
Budden, Hanbury A. 75
Butterfield & Co. 84

C

Canada Machinery Agent 16
Cansda Metal Co. 16
Canadian Pneumatic Tool Co 85
Canada Chemical Mfg. Co. 16
Canadian Buffalo Forge Co. 9
Canadian Fairbanks Co. 20
Canadian General Electric Co. 66
Canadian McVicker Engine Co 73
Canadian Rand Drill Co. 84
Canadian Westinghouse Co. 1
Carr, John. 65
Chadwick Bros 76
Clark-Demill Co. 18
Cleveland Automatic Mach. Co. 10

D

DeCew, J. A 75
Detroit Testing Laboratory. 75
De Clercy, Jules 75
Diamond Saw and Stamping Works ... 80
Dillon A., & Son. 80
Dodge Mfg. Co 11
Dods. P. D. & Co. 81
Dominion Foundry Supply Co 76
Dominion Henderson Bearings 10
D'Olier Engineering Co. 16
Dominion Belting Co. 76
Dunlop Tire & Rubber Goods Co. 88

E

Economical Mfg. and Supply Co 15
Economic Power, Light and Heat Supply Co 74
Electric Blue Print Co. 75
"Electrical Times 88
"Engineering" ..... inside back cover
Engineering Specialties Co 80
"Engineering Times". 88
Expanded Metal and Fireproofing Co. 83

F

Fetherstonhaugh & Co. 75
Fetherstonhaugh & Blackmore. 75
Fielding, John S. 75

G

Gibb, Alex 81
Geometric Tool Co. 86
Globe Machine & Stamping Co. 76
Goldie & McCulloch Co. 1
Greening, B., Wire Co. 78

H

Hall Engineering Works 10
Hamilton Facing Mills Co 77
Hamilton Pattern Works 65
Hart Mfg Co. 80
Howard, Geo. H. 10

J

Jardine, A. B., & Co. 78
Jenckes Machine Co. 12
Jessop, Wm., & Sons 79

K

Kay Electric Dynamo & Motor Co. 14
Ker & Goodwin 78
Kerr Turbine Co. 74

L

Laurie Engine and Machine Co. 15
Lewis, Rice, & Son. 87
Link-Belt Co. 14
London Machine Tool Co. 4, 5

M

Manitoba Iron Works 12
McDougall, R., Co. 8
McDougall, John, Caledonian Iron Wks 13
McEachern Heating & Ventilating Co. 10
McLean, W. B. & Co. 15
Marion & Marion 75
Merrell Mfg. Co. 14
Millen, John, & Son. 2
Miller Bros. & Toms 80
Morrow, John, Machine Screw Co. 83
Morse Twist Drill and Machine Co.... 79
Morton, B. K. & Co. 79

N

National Machinery Co. 75
Nicholson File Co. 79

O

Osborn Mfg. Co. 76
Otis-Fenson Elevator Co. inside back cover

P

Pacific Coast Pipe Co., Vancouver, B.C. 15
Packard Electric Co. .....inside back cover
Parke, Roderick J. 75
Paxton, J. W., Co. 77
Penberthy Injector Co. 78
Pendrith Mach. Co. 80
Petrie, H. W 19
Plews & Trimingham 75
Potter & Johnston Machine Co. 10
Pratt & Whitney Co. ....inside front cover
Pringle, T., & Son 75

R

Remington Typewriter Co. 75
Ridout & Maybee. 75
Robb Engineering Co. 13
Royce, James C. 75

S

Sheldons Limited 9
Smart-Turner Machine Co 6
Standard Bolt and Screw Co 83
Standard Tool Co 84
Starrett, L. S., Co. 84
Stevens Co. of Galt. 3
St. Lawrence Supply Co. 73
Sturtevant, B. F., Co. 8
Sylvester Mfg. Co. 16

T

Taylor & McKenzie 78
Technical Pub. Co. 87
Toronto and Hamilton Electric Co 77
Toronto Plate Glass Importing Co. 65

U

Underwood, H. B., & Co. 81
Union Drawn Steel Co. 2

V

Volta Electric Repair Works. 83

W

Warner & Swasey Co. 3
Waterous Engine Works Co. 12
West Haven Mfg. Co. 79
Wells Pattern & Model Works. 65
Williams & Wilson 17
Whitman & Barnes 84

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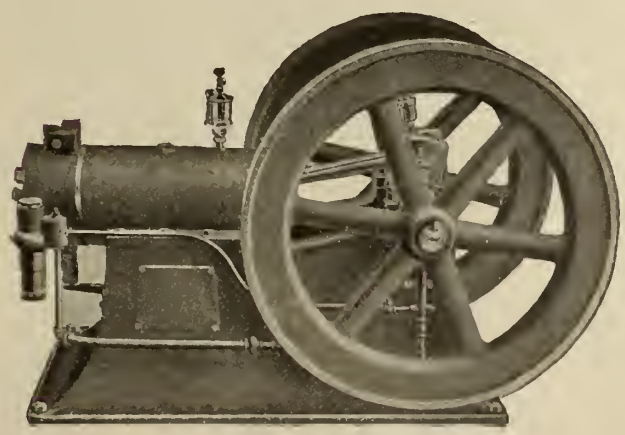

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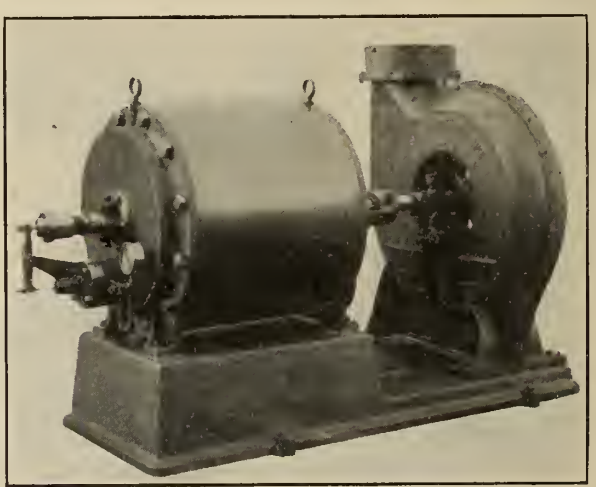

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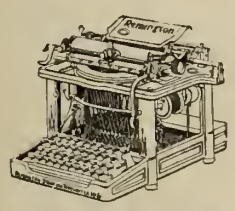

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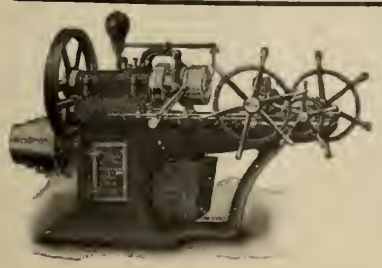

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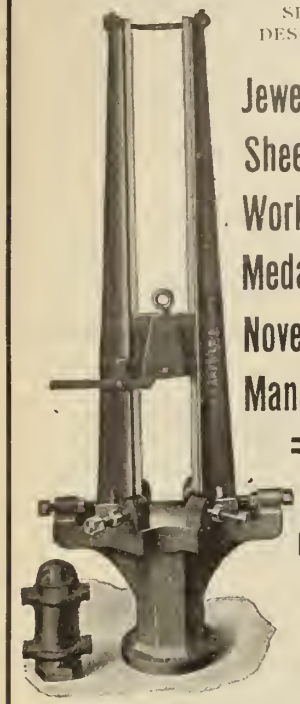

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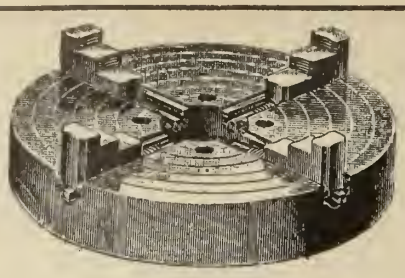

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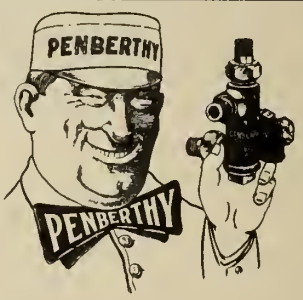

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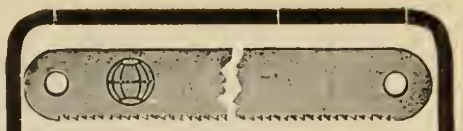

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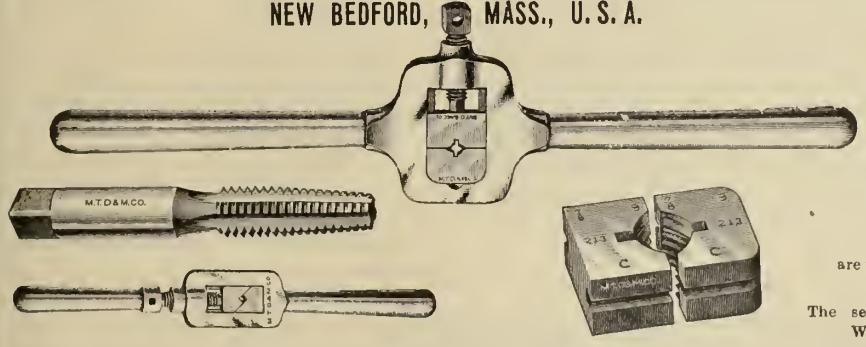

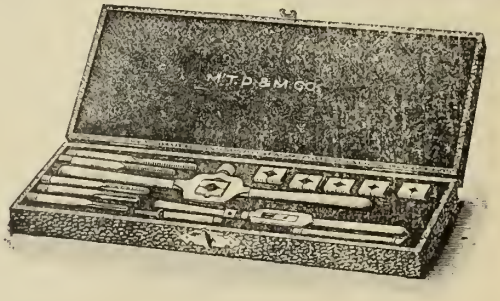

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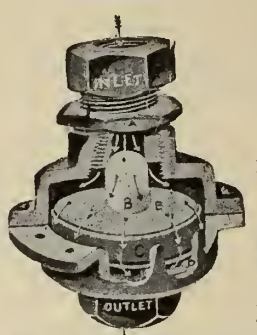

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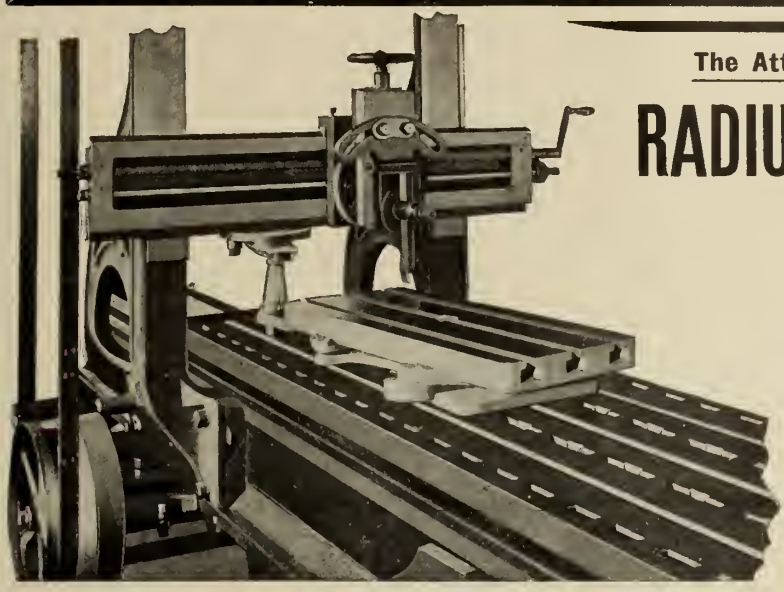

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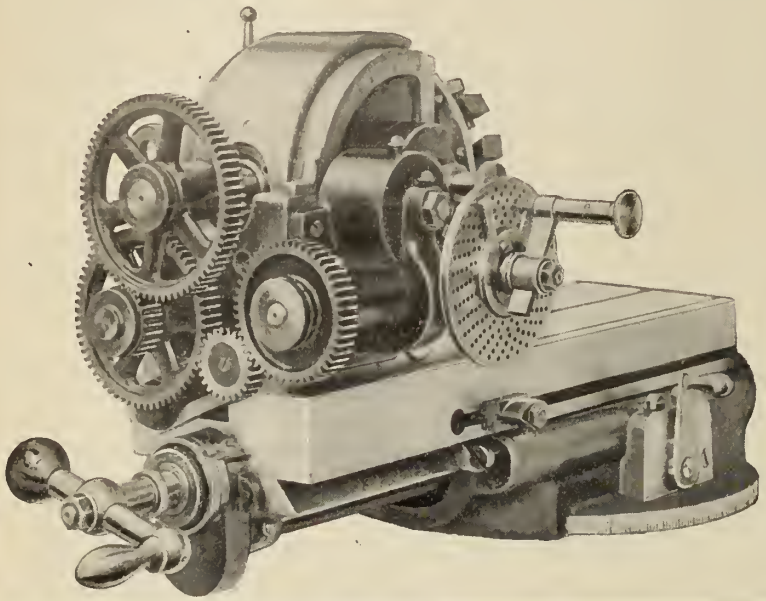

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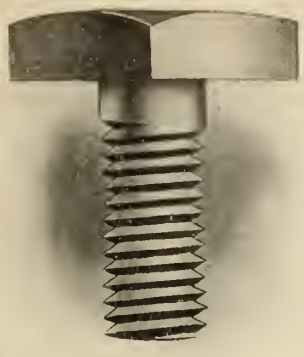

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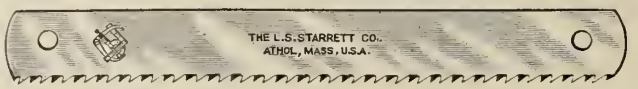

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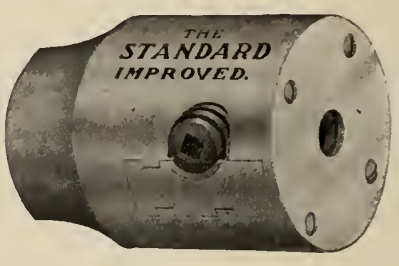

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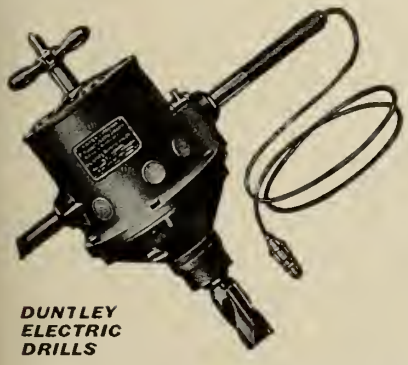

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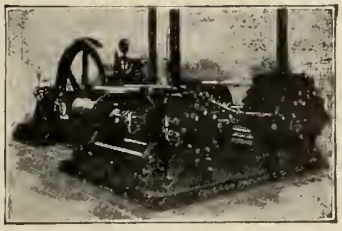

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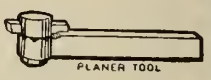

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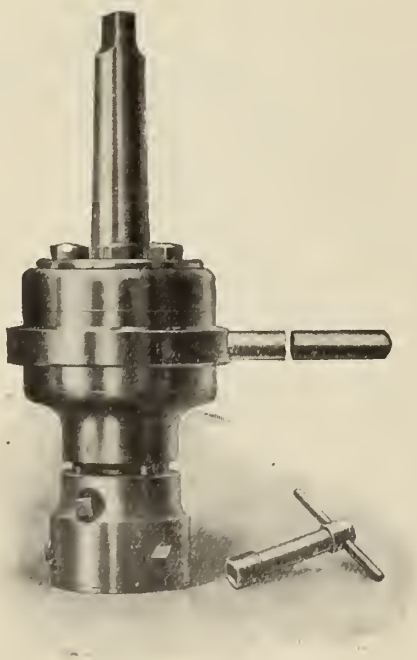

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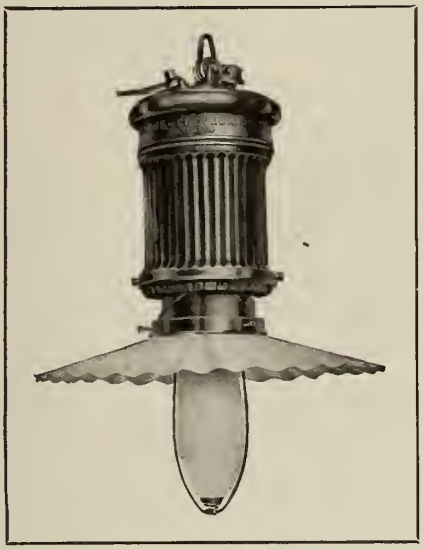

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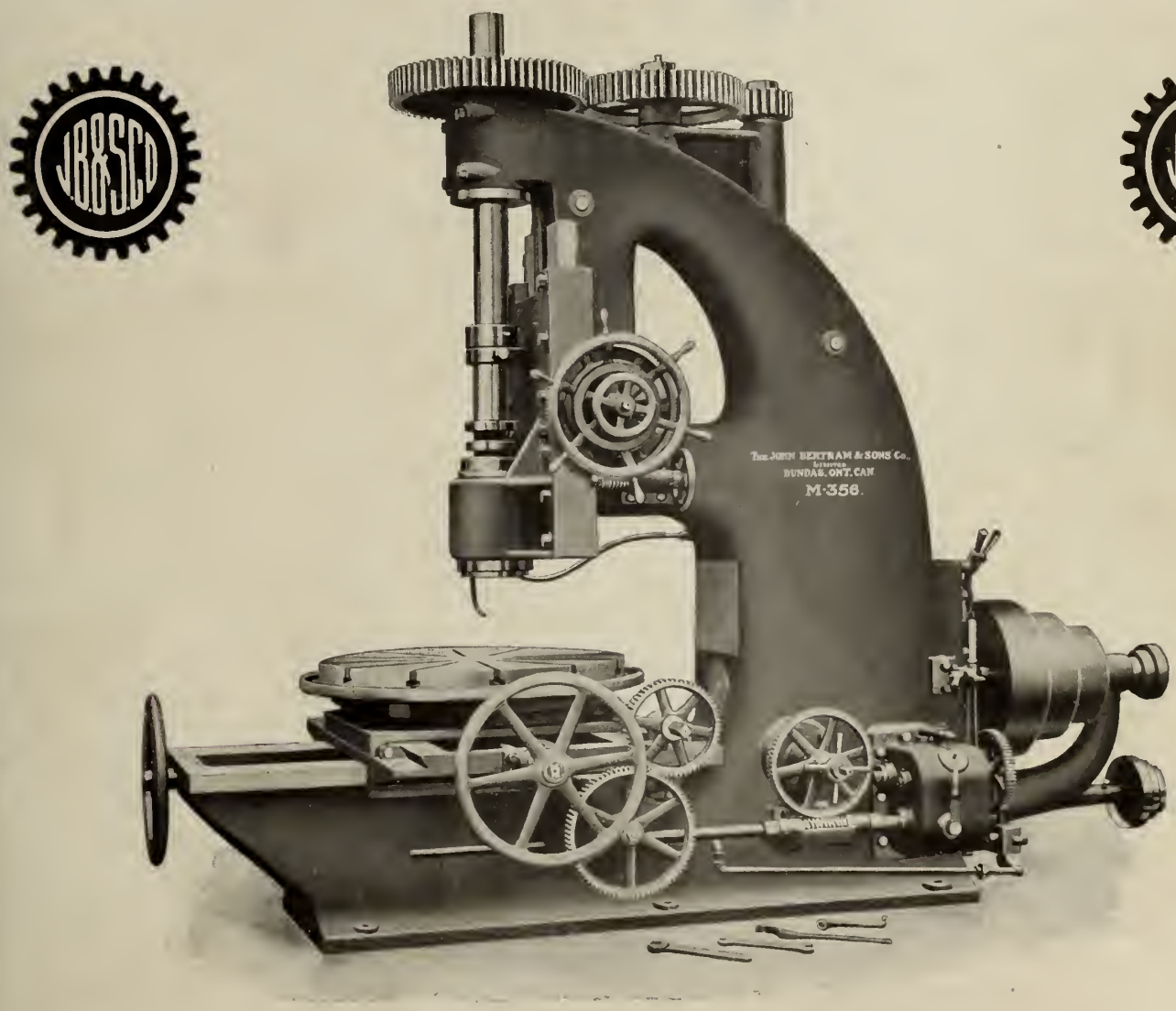

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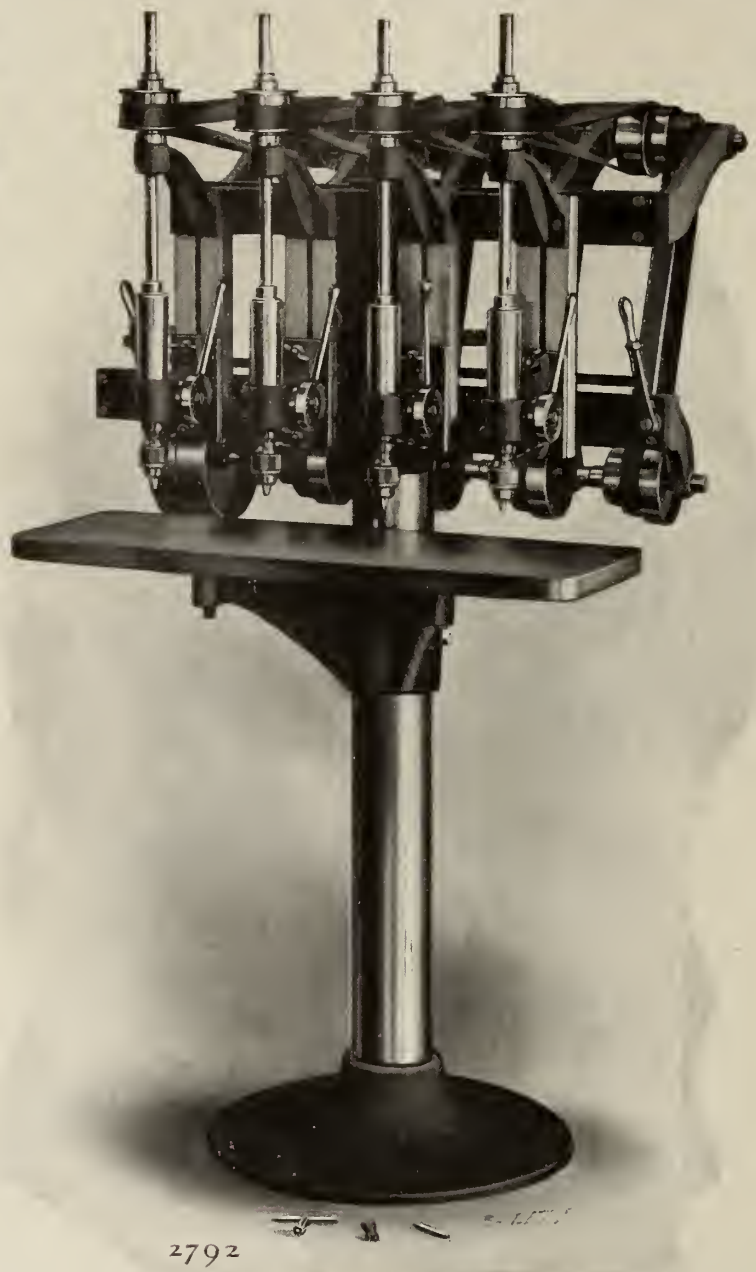

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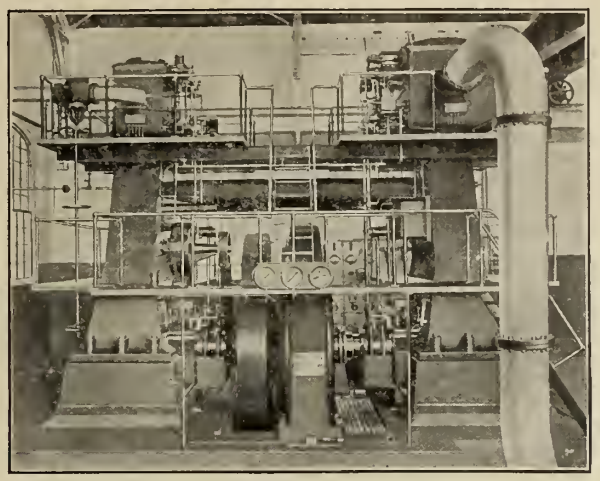

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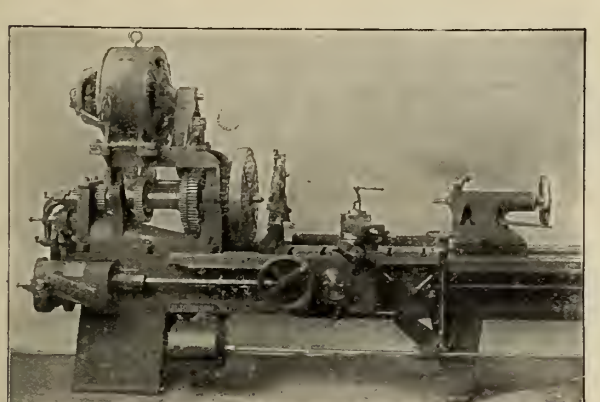

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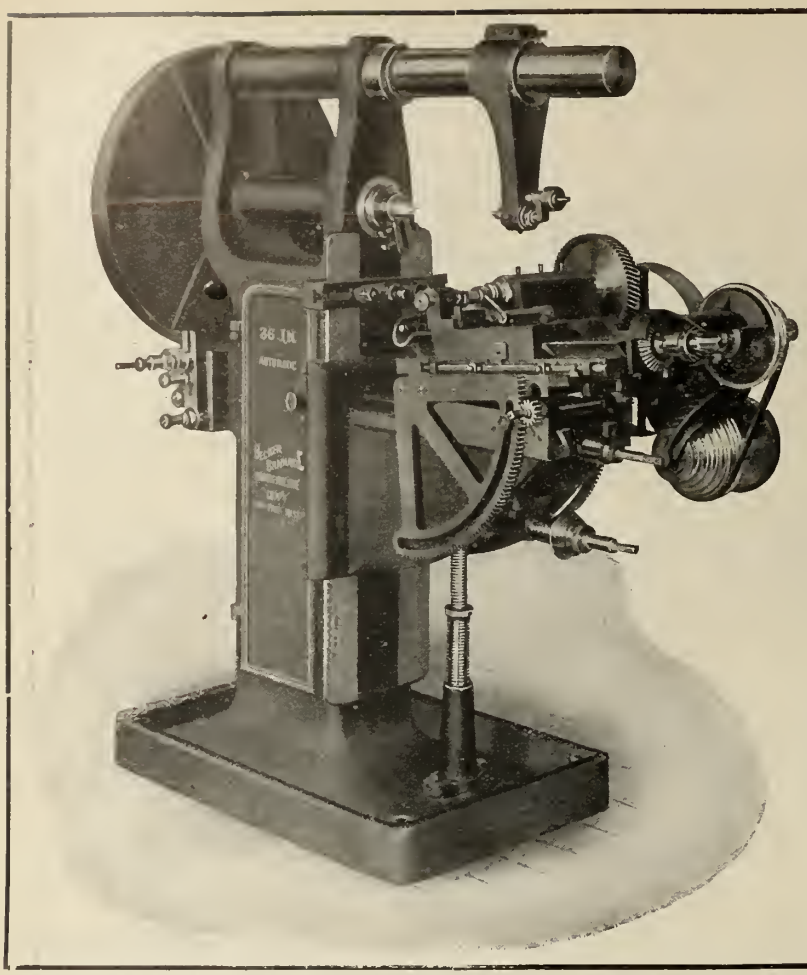

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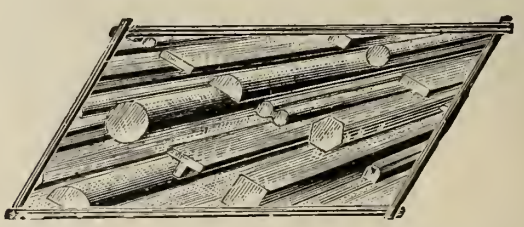

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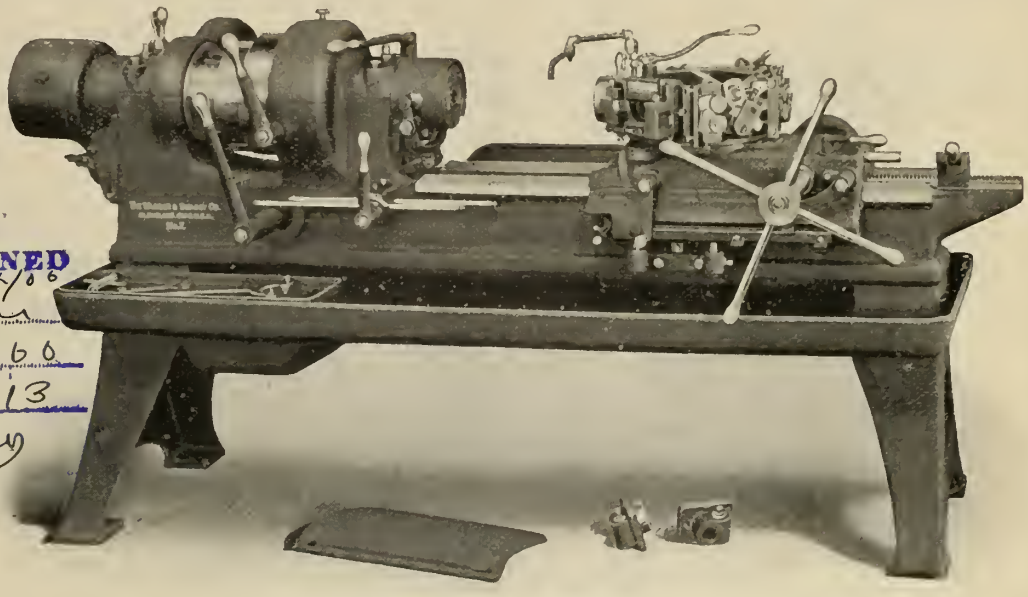

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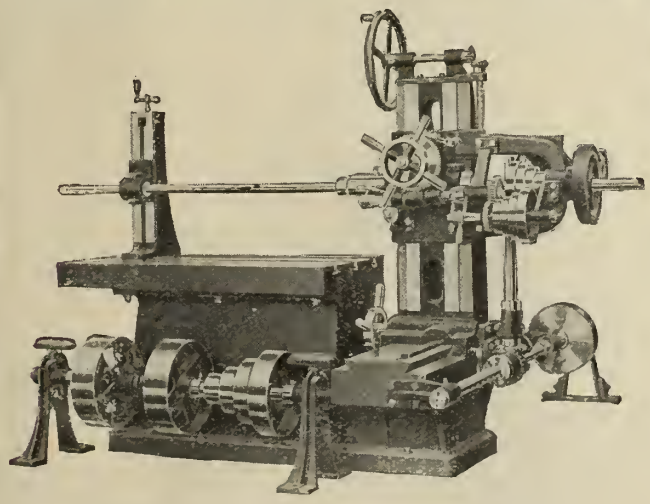

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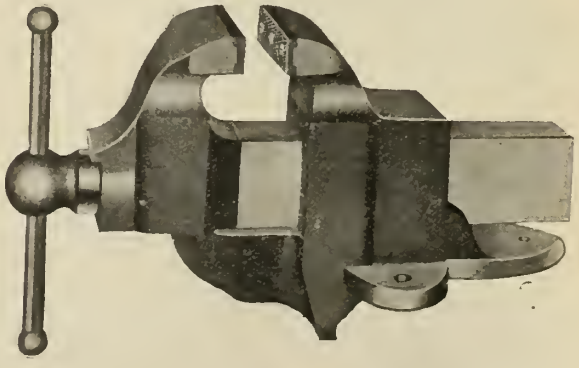

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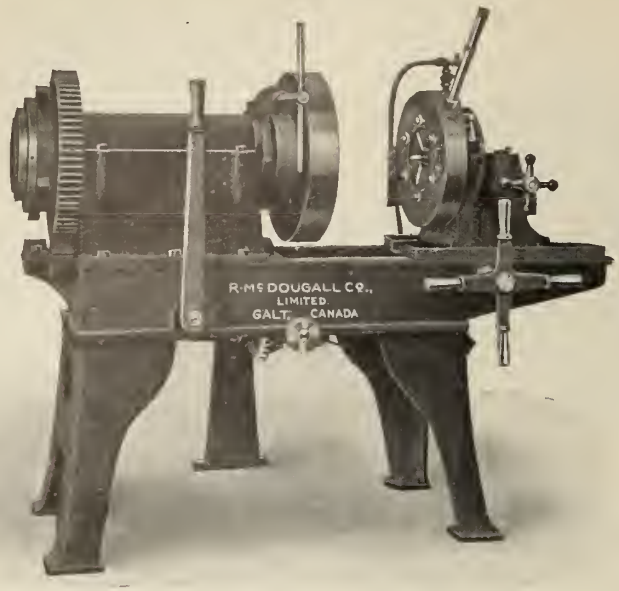

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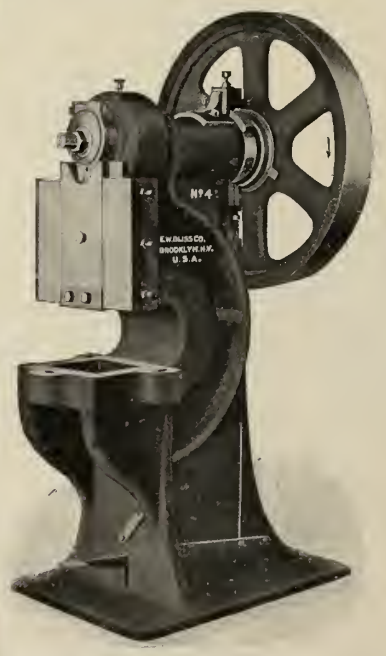

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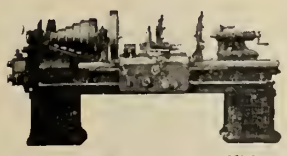

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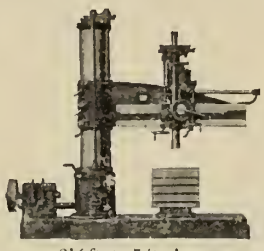

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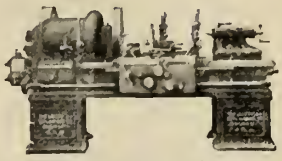

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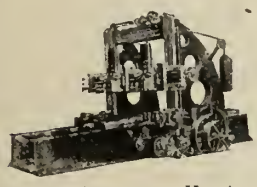

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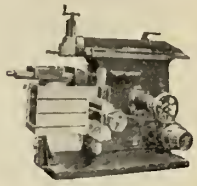

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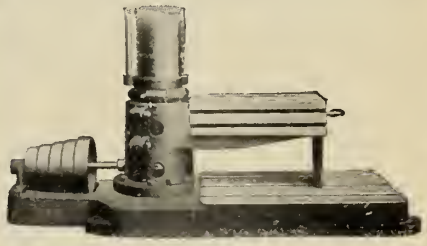

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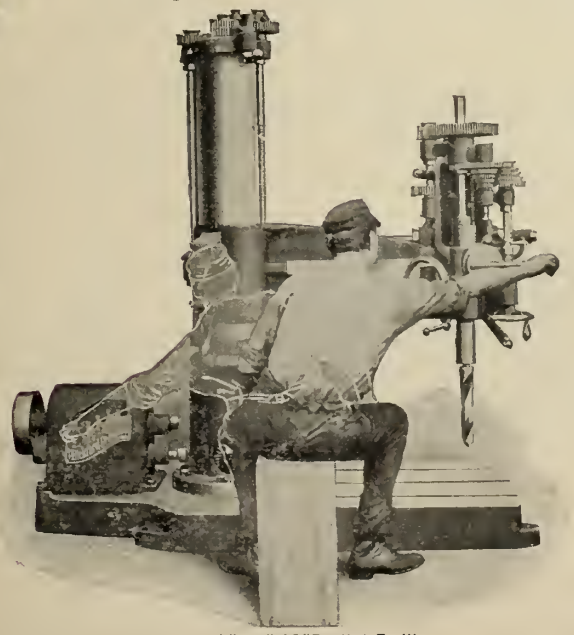

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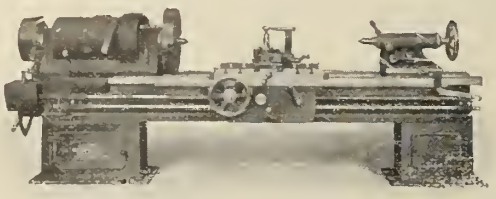

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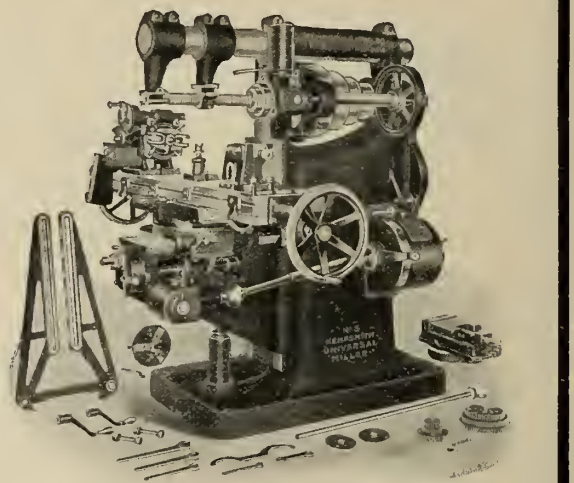

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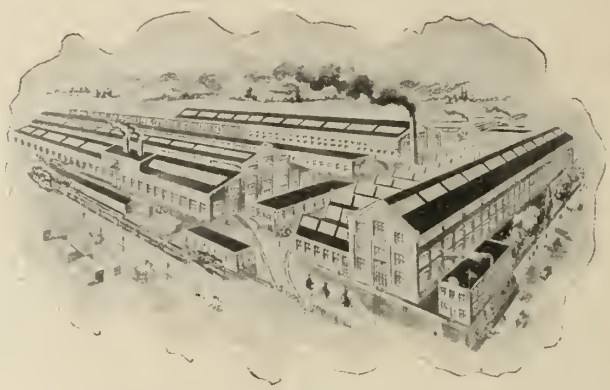

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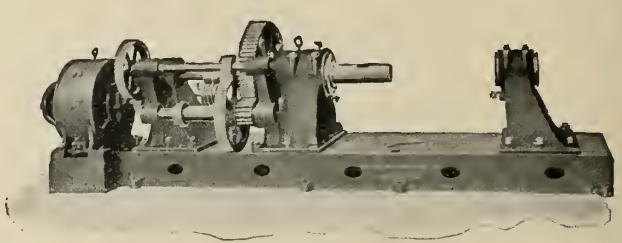

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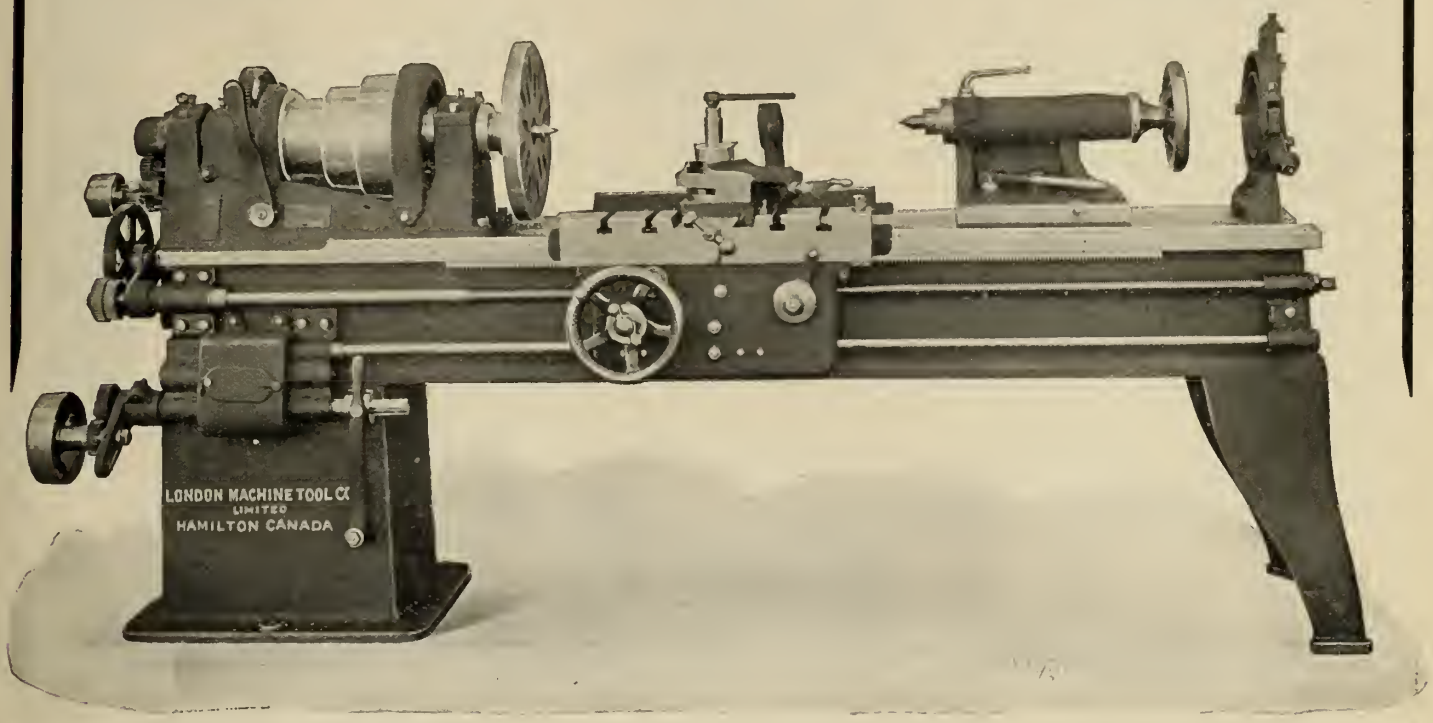

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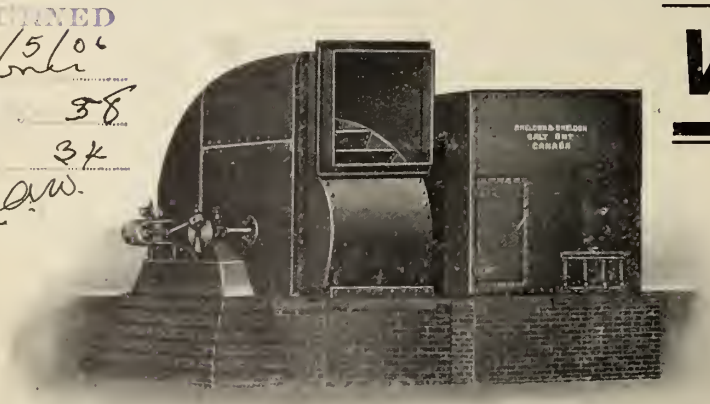

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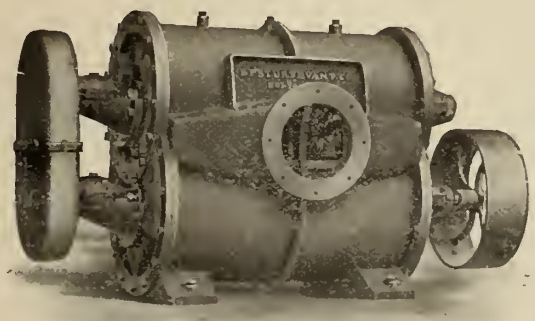

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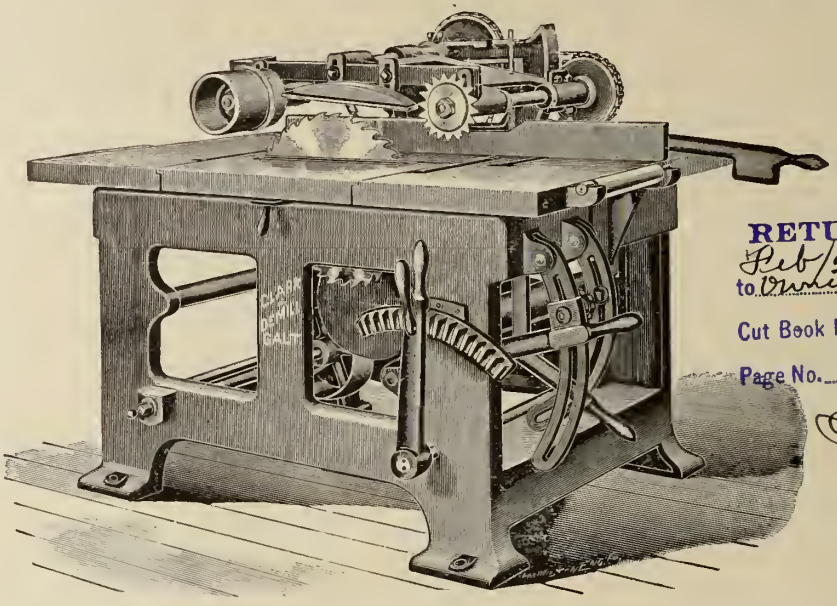

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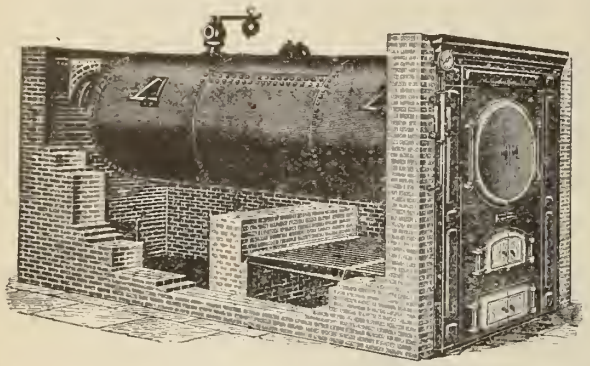

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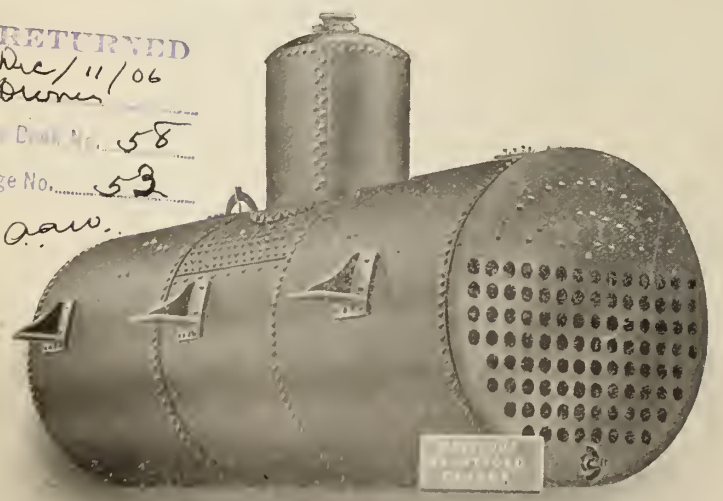

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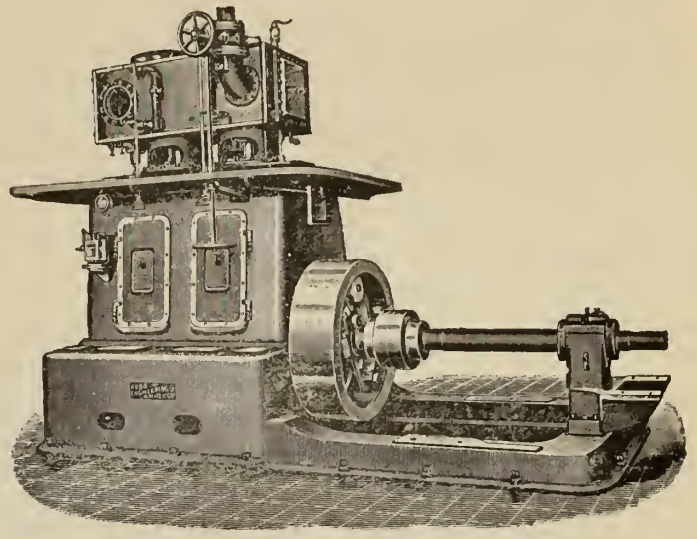

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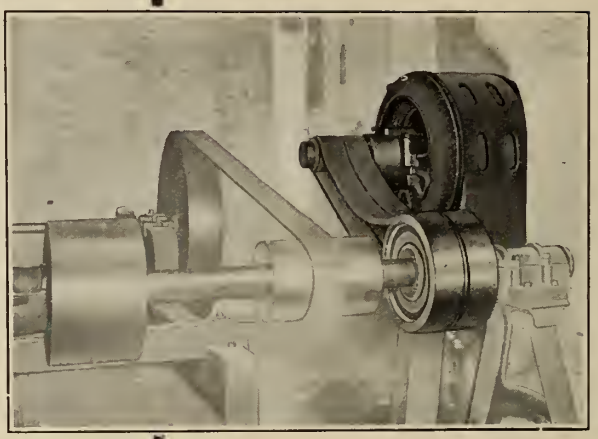

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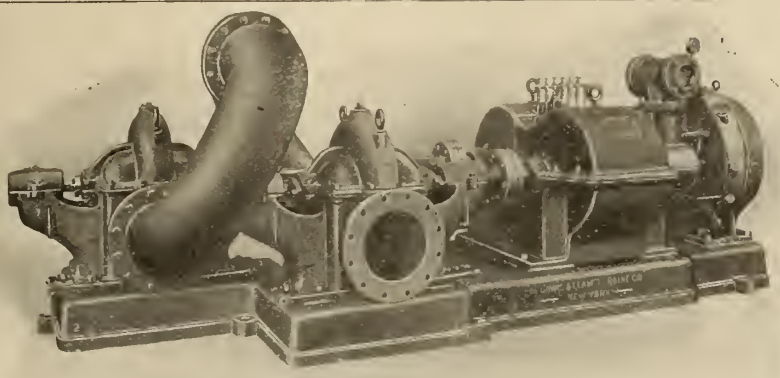

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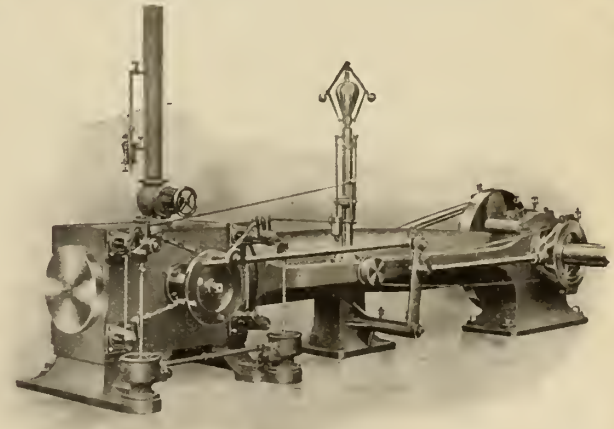

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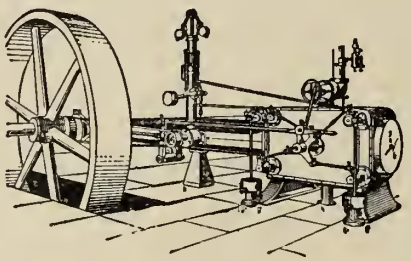

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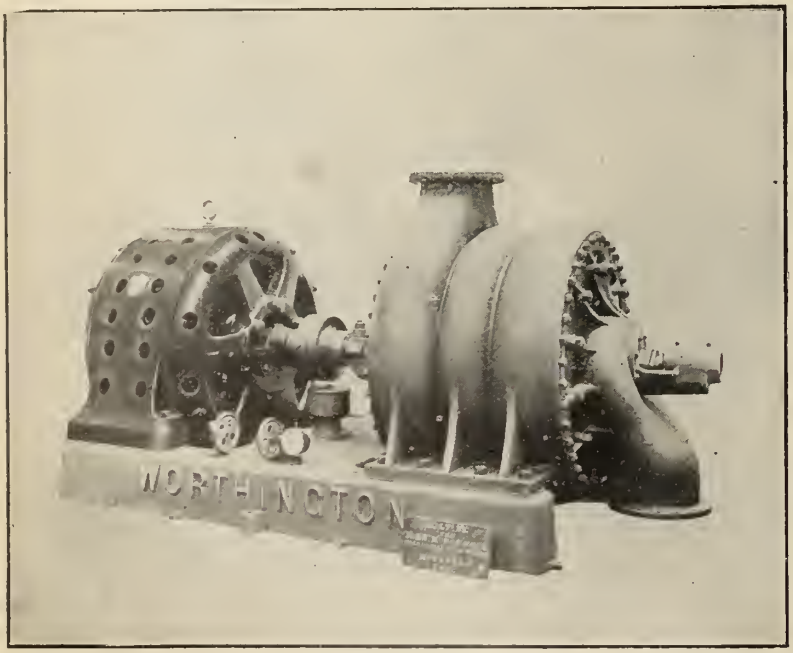

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A Town's Industrial Awakening

After Many Years the Town of Welland, Ontario, Suddenly Realized Its Future as a Manufacturing Metropolis

OPPORTUNITY knocks but once, it's said, but for a whole generation this supposedly elusive visitor has hovered about the threshhold of Welland, awaiting but a nod to enter and revolutionize the town. Opportunity has come. Nine new industries have been added to the town within a year, a feat not heretofore paralleled for a town of its size in Canadian industrial history. From all appearances the onward tide must continue until the once standstill hamlet has become a centre of manufacturing industry unsurpassed on the Western peninsula of Ontario. This is strong language but is backed by stronger evidence. Great events are known to spring from incidents of small import. The loss of an industry that might have been kept marked the turning point in Welland's career, and initiated a movement that will create there a city in the immediate future. The seal of progress has been stamped upon the municipality and it cannot turn back. It is marked for greater strides that must inevitably follow in the train of what has already taken place. With advantages a dozenfold greater than many other Canadian towns, it possess potentialities that make possible a second Pittsburg such that a prophesy in this direction has very material evidence of future fulfilment.

Far Reaching Advantages.

In a word Welland has probably the cheapest transportation, cheapest natural gas, cheapest electric power and light and the most inexpensive land values to be found in Canada. A well laid out town with fine public buildings and pleasantly situated in the healthiest district in the world where a progressive and aggressive citizenship exists, the centre of a rich agricultural district, and a proximity to the largest fruit farms and nurseries in Canada are a further combination adding to the desirability of residence in this much favored centre.

Unique Transportation.

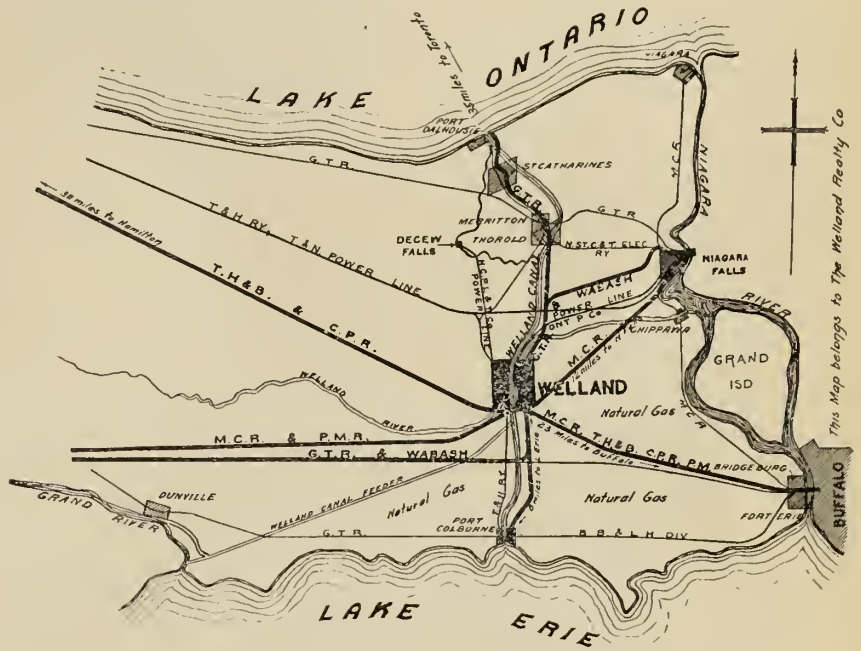
First and foremost of these advantages are its unique transportation facilities. The fact of the town's situation at the head of deep water navigation from the Great Lakes gives it a commanding position over other places, insuring beyond peraventure its bounding to the forefront in proportion as the signification of this becomes generally recognized. Railway facilities are superb. The town is located on every trunk railway line in Canada, of which there are five. This leaves no possible want from a shipper's point of view.

The Welland Canal the great shipping channel between the east and west passes directly through the centre of Welland. From Duluth to near Welland the waterways will accomodate vessels drawing twenty feet. From Welland to the Atlantic fourteen feet is the greatest draft. This makes the town the natural lightering point for heavy freight from the West, and consequently a place for manufacturers to locate. To accomodate the deep draft vessels from the West, the Government are building a large turning basin which will make, eight miles inland, one of the finest harbors connected with the Great Lakes. Thus shippers get the lowest of lake rates inward and to and from the seaboard, which gives them the advantage of inland competitors on all freights during the season of navigation.

Welland is in the Buffalo district for rail shipments and has the same freight rates as that city on all goods coming into Canada from the United States. The Grand Trunk, the Toronto Hamilton & Buffalo, the Michigan Central, C.P.R., the Pere Marquette and the Wabash all enter Welland. Thirty-six passenger, mail and express trains go and come every day, making it possible to get in or out of the town at almost any hour of the day or night. It follows with no need of comment that freight facilities are proportionately excellent.

25c Gas and $15.00 Electric Power.

Here is found the cheapest light and power enjoyed by any municipality in Canada. To show Welland's position regarding the availability of electrical energy for light and power needs but a mention of the recent call for tenders to light the town, where five competing companies bid, the contract going to the lowest tenderer at a rate not known elsewhere in Canada, possibly in America. $40 an arc-light year, all night and every night. Niagara Falls is but twelve miles distant with its 5 power companies, and electrical power is available in Welland to-day for the startlingly low sum of $15.00 per h.p. per annum. Electric power is also being delivered from De Cew Falls, by the Cata-



Map Showing Welland as Railway Centre

ract Power Company. Natural gas is abundant. Its abundance makes it cheap. In fact it is sold at so low a figure that people leave their lights burning in much the same manner as electric lights are left on in places where a flat rate is imposed. People heat and light their homes with natural gas. Manufacturers have it ready to run their plants. The cost to the consumer is but 25 cents a thousand cubic feet. This makes it possible to produce power by means of gas engines in the neighborhood of $8.00 a year. What other town can make such a boast as this?

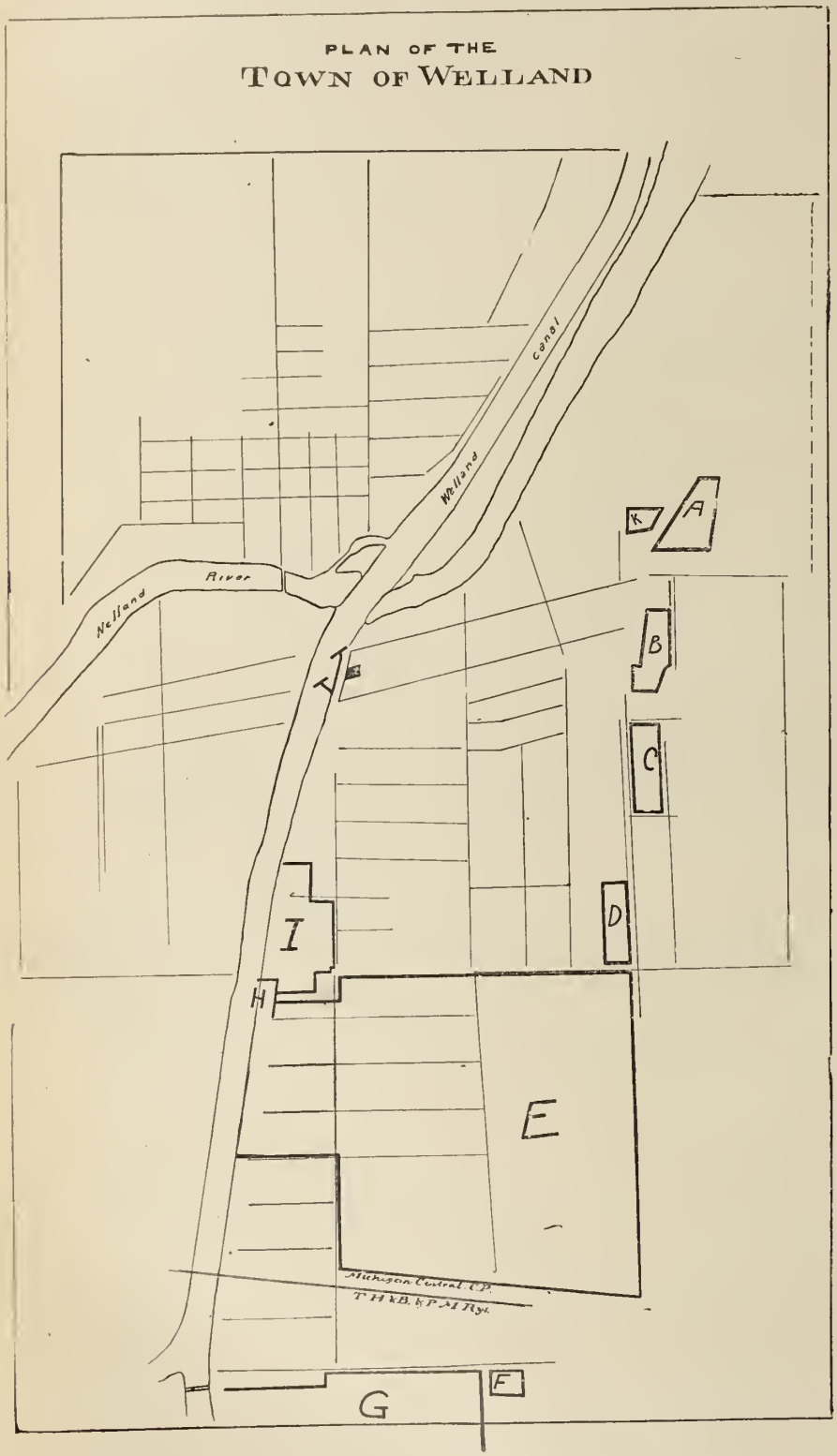
Some Other Features.

Welland is the county town of the County of Welland. This county is one

of the most aggressive in the forward movement for good roads and has arranged in conjunction with the Ontario Government to build 170 miles of permanent roads at a cost of $1,500 a mile or a total cost of $255,000.00. This system will radiate from Thorold, Niagara Falls, Bridgeburg, Fort Erie, Port Colborne, Wainfleet, Pelham to Welland and will include all centres of population in the county as well as connecting leading roads from adjoining counties.

A system of water works has been provided to supply a town five times that of the population of Welland in 1905. The water supply is taken from Lake Erie. The town is well sewered.

10 miles of concrete walk have been built.



INDUSTRIAL DEVELOPEMENT IN ONE YEAR;
(A). Barcalo Bed Works; (B). Supreme Heating Co., Works; (C). Canada Forge Co; (D). Robertson Machinery Co; (E). Plymouth Cordage Co; (F). Cheese Factory; (G). Ontario Iron and Steel Co; (H). Turning Basin; (I). M. Beatty and Sons; (J). Welland Realty Co.

A perplexity in the town at present is the house problem. The new industries already started will require the influx of hundreds of mechanics and several hundred houses must be built almost immediately to supply the demand.

A Bit of History.

A decade ago the town of Welland contained a newspaper, the works of M. Beatty & Sons and Robertson Bros. The first industry to come to the town was the Frost Wire Fence Company, who got a grant amounting to $600.00 distributed over three years. In the grant was an old church, used as a factory, and part of the fuel. At this time it was hard work to interest the citizens of Welland in industrial advancement. The Frost Company prospered and grew and about five years ago built a new place on the G.T.R. near the station. The council of that day agreed to give the Frost Company exemption of all taxation except the school tax, but neglected putting the by-law to the people. In the course of about three years an antagonistic council was elected who refused to remit the taxes. The by-law was then put to the people and defeated, resulting in the Frost Wire Fence Company moving to Hamilton.

This marked the turning point in the career of Welland's industrial development. It was a signal of awakening in the town. When the people realized they had lost the only plant they had been successful in obtaining for a number of years they suddenly became aware of the importance of attracting industries to their town which has so much to offer. Every man in town with any sense of citizenship at once put his shoulder to the wheel with wonderful results.

Recent Industrial Progress.

The first industry to come to the town was the Canadian Barcalo Co., manufacturers of iron beds who employ about twenty men. They took the building of the Frost Wire Fence Company and the town was glad to give the terms previously refused the former company. Then the greatest triumph for the citizens of Welland culminated with the decision of the Plymouth Cordage Company of North Plymouth, Mass. to establish their Canadian factory there. After looking over the advantages of various towns the company refused a bonus of $75,000.00 cash from one municipality stating that with Welland's advantages that amount would be saved every year. The company have secured 180 acres of land. Buildings are all erected. The machinery has been nearly all installed, and operations will commence immediately. For the property, plant and equipment,

houses. etc., the company have spent $1,000,000.00.

Next on the list was the reorganization of Robertson Bros. into the Robertson Machinery Company to manufacture hoisting engines and to carry on a general machinery business. The company was formed by Welland capital,

Large Freighter in Welland Canal

Mr. C. H. Hanson, leaving the Frost Wire Fence Company at Hamilton to take up this work. At the present time the company has five acres of land on the Grand Trunk on which the firm intend building two buildings one 150 by 40 and the other 150 by 60 feet, comprising machine shop, foundry and blacksmith shop. This will increase the facilities about 400 per cent. The calls for orders for this company during the past year amounted to five times the the output.

A by-law affecting the Ontario Steel & Iron Company which proposed establishing at Welland and M. Beatty & Son who were already established was put to the people at the same time, both of which passed with only 2 decenting votes. The firm of M. Beatty & Son are building an enormous new plant of the finest structure possible and asked for a fixed assessment of $10,000.00 for twenty years. The Steel & Iron Company asked for $6,000.00 or a site when they had paid out $100,000.00 for a plant and $100,000.00 a year in wages. This firm is aggressively going ahead and will be in active operation within a very few months.

The next industrial enterprise to come before the attention of the people of Welland was the Iroquois Motor Company and a by-law was passed granting them their request of a site of three acres of land and a fixed assessment of $6,000.00. The foundation of their building has already been built.

History was being rapidly made. Shortly after this another double by-law went before the people, and passed as former ones had, which affected the Supreme Heating Company and the Canada Forge Company. These two by-laws asked for land aggregating $3,300.00 and water extensions amounting to $2,000. The assessment was fixed at $2,000 each for ten years. The Canada Forge Company is an aggressive organization with Mr. Thos. J. Dillon as president and general manager. Their works are now completed and ready for installation of machinery, making a record in building construction. The Supreme Heating Company was an American concern, the Canadian branch being formed in this country and Canadian capital fostering it.

This in brief shows the wonderful advance that has come to Welland within the past year. It demonstrates more strongly than anything else that Welland must have extraordinary natural advantages to attract so many industries in such a short space of time and at practically no financial outlay. The future of the town of Welland is bright indeed. Enough has been done to demonstrate how much more is possible. The momentum already acquired must carry the town forward industrially and must see it, in less than two years a busy manufacturing city throbbing and pulsating with industrial activity.

The Welland Construction Co.

With such a large amount of building under way in the town of Welland, it is important that a construction company should be established. Only a few months ago the Welland Construction Co. was organized, and already are engaged on a number of the most important building contracts in the town. At present the company are at work on the construction of the iron and steel plant, which is to be in operation about the first of May. They have established a record in building construction in the completion of the Canada Forge Co.'s plant, on Nov. 17, the works being under construction 26 days. One of the greatest secrets of the success of this company is the fact that they have at their disposal an unlimited amount of labor. Coupled with this, is the embodiment of the latest methods in building construction with a practical experience that brings results. The agreement of the Iron & Steel Co. with the town, calls for forty houses before the plant is operating. These likewise will be erected by the Welland Construction Co., who have taken hold of the building up of the town in an admirable manner. Work already done by this company has received high commendation from various sources, and the town of Welland is glad to have in its midst a company capable of handling the problem of construction, that must confront the municipality in the near future.

A Familiar Scene at Welland, Ont.

The Advantages of a University Education in Connection with Railway Work *

By Dr. H. T. Bovey, of McGill University

PERHAPS a brief history of the establishment of a course of railway education in McGill may be of interest. At a time when the Grand Trunk and the Intercolonial were the only main railways in Canada, it was my fortune to come to this country. I came for the winter, and the winter suited me so admirably, that I decided to make Montreal my home. Having, therefore, made up my mind to throw my lot in with this great Dominion, I thought I would do what I could to advance the education of young engineers. I had been one of the engineers on the Mersey Docks for some years, and was fortunately employed on many important works of construction, so that I may claim to be not an entirely theoretical man. In the year 1880 I went to Mr. Brydges, who at that time was General Manager of the Grand Trunk Railway, and endeavored in my most persuasive language to ask him whether the railway could not combine with us in outlining a course adapted for the training of railway men in all departments of the service. Mr. Brydges did not take kindly to the suggestion and characterized it as the idea of "another of those theoretical men." "We have our own way," said he, "of training up engineers, and we are quite satisfied." I remarked that it was evidently no use asking him to do anything in the matter, but that the time would come when the railways themselves would take the matter in hand.

A few years ago Sir Thomas Shaughnessy generously volunteered the proposal that the Canadian Pacific Railway would give its support to any well-devised scheme for the proper training of railway men, expressing the opinion that the future railway man must be trained along university lines. Mr. Hays, who was also present at the time, acquiesced in this opinion, and promised similar support on the part of the Grand Trunk. The present railway department at McGill University is the direct result of the far-sighted views of these eminent men. Soon after the co-operation of the Intercolonial and the Great Northern Railways was secured, and the future of the railway department at McGill became assured.

The railway courses are divided into two parts. There is the theoretical branch, which we, and probably every railway man, consider most essential on this subject. I have received communications from distinguished railway presidents, managers, engineers, etc., and they all express the opinion that a certain specified theoretical training is of the highest importance in every department. They further say, however, that important as the theoretical training may be, it is largely nullified without a practical knowledge of their work. The question became then, how was that practical experience to be gained? and the difficulty was met by the railway companies agreeing to do their part in providing the practice. After discussing the matter with the railways interested, we came to this conclusion, that, possibly the preliminary practical

Dr. H. T. BOVEY.
Dean of the Faculty of Applied Science, McGill University

experience, or what might be called the student apprenticeship, could be gained during the summer vacations, and the railways agreed to take a certain number of students. While the students are with them, they agree to place them in different departments of the work, so as to give them—not a complete knowledge, which is impossible in the few months at their disposal—but to give in a general way a preliminary training in railway work. This continues for three summers, and reports are prepared, which are returned to the railway officials, who in this manner get to know exactly what these young men are doing.

In my own opinion, the success of the whole scheme depends largely upon the proper carrying out of this apprenticeship system, and especially the apprenticeship after graduation at the university. The young graduate is then expected to spend a couple of years with the railways, being moved about from department to department until it is found in what particular department he may give the best service, and if he is the right kind of man his future is then assured.

Again, it was considered unwise to appoint a permanent professor of railway management or of other essentially practical departments, because the railway manager of to-day, if he separated himself from active railway work to-morrow would be out-of-date. The lectures then, which are to give some idea of railway management, of freight and passenger traffic, etc., are to be given by men in active practice.

Well, the railways with ourselves seemed to think, at all events, that we might make a trial by starting along these lines, and I believe the course as now outlined will prove successful. I believe that we shall turn out men who will be worthy to succeed those who have gone before them, and I think the young men of this country will have an opportunity such as their fathers never before had.

In working out this scheme I might say that it took two or three years to get all the information, and most of the prominent railway men on this Continent were approached. Their views, perhaps, may be of some little interest to you as showing what they think of the whole scheme. As now outlined by Mr. Morgan, it indicates pretty clearly the course we are to pursue at McGill, and this course has received the approval of the great railroads of this Continent.

I would like to quote you a few opinions on this subject, because, as I said at first, there is nothing in the new proposals which has not been supported by prominent railway men.

Mr. Carstensen, of the New York Central Railroad, writes:

"The great advantage to a young man of a university training is that it moulds his mind, and fits him to deal with affairs and men of affairs. As at present conducted, the education obtained in universities does not seem to produce men who, at first, are of as

* An address before the Canadian Railway Club, Montreal, on October 2, 1906.

much value to the railway service as the boy trained up gradually from the lowest to high positions, but subsequently it has been found that the university-trained man moves forward more rapidly on account of the wider breadth of view inculcated by his superior education, although he may not be able to deal with small details as the boy from the common schools."

Mr. Carstensen is strongly of the opinion that the university-trained men will be productive of the very best results. His company, the N.Y.C.R., employs a large number of graduates, and he gave me many instances of their success, comparing their progress with the progress of those coming from the common school, and gradually working their way up from the office.

Then, as you know, the Pennsylvania Railroad has always insisted upon the employment of university-trained graduates in certain of their departments. They have two classes of apprentices, viz., a class of special apprentices, consisting solely of college graduates, and a class of ordinary apprentices. If any of these ordinary apprentices show any marked ability, they give them leave of absence, and allow them to go to a university in order to get that theoretical training which will make them more valuable to the railroad. On their return, they are immediately placed in the class of special apprentices. Mr. Atterbury, General Manager of the Pennsylvania Railroad, says, that the rule of employing university graduates has been extended, as far as possible, to all other depart- of the railroad, and with the best possible results.

Considering again the locomotive department, with which many of those present are so intimately connected, I should like to quote the opinion of Mr. Vauclain, of the Baldwin Works. He says :—

"The ideal training for a student intending to take up locomotive work should be a general college education along the lines of Mechanical Engineering, extending over a period of two or three years."

He says better results might be obtained if the student could be required to take a post-graduate course in some railway works.

The greater responsibilities and the greater rewards in the operation and management of railroads are generally given to those who have been trained and developed in the actual service. The result of this state of affairs is that the railroad student is used for railroad construction rather than for railroad operation. The mass of information necessary for the operation of a railroad cannot be obtained in the class room, but must be acquired in actual experience in railway work.

Speaking of the work we propose to do in McGill, Mr. Atterbury is of the opinion that such a course should assure for railroad managers and assistants greater intelligence and greater usefulness than the present methods.

As far as the operation of a railroad is concerned, we have, I think, solved the problem by establishing in connection with this railroad scheme what we call the operating department. We have specialize on the civil, the mechanical three distinct branches, and you can side, the operating side, but in each of these departments everyone taking this railroad course must take certain subjects that are common to all, such as economics. In addition, we also give them in the third and fourth year a broad literary training. I would like to emphasize this fact rather fully, because we find that young men who come to us often do not know how to write a letter, and very often do not know how to say what they want to say. A great railway manager told me, about eighteen months ago, that he had had during the year several hundred applications for positions. These applications came from graduates from technical schools all over the continent, and only a very few were expressed properly, or in good language, or grammatically. Of course, this is a very lamentable showing, but we hope to get rid of such a criticism ourselves by continuing their English training in the third and fourth years

Amongst other people interviewed, and who showed the greatest interest in our scheme was Mr. A. W. Gibb, General Superintendent of Motive Power of the Pennsylvania Railroad, Altoona, Pa. He wrote me a long statement, and thus closed his remarks :—

"Taking it altogether, I think the course is one to be very much commended, and while I do not think that from any technical institution full-fledged railroad men will ever emerge, I think that such a course will save future railroad men much of the threshing of old stuff which a man without this training would have to go through.

"If you can get a man to think straight, I think the rest will depend upon his opportunities, and upon the use he shall make of his training."

Mr. Berg, Chief Engineer of the Lehigh Valley Railroad, and eminent also for his writings on this subject of engineering education, says :—

"The higher branches of the railroad should be considered as a profession, and as a profession provision should be made for an adequate training. The misplaced belief that practice can only be learned in practice has caused thousands of boys, not only in railway service, but also in mechanical and industrial pursuits, to be consigned yearly to the same rut, as others before them. Taken as a whole the young man may be able to become familiar with data and statistics, but experience is a very slow teacher, and it is usually costly to the party that pays the bills."

Opinions of this kind from men like Sir Thomas Shaughnessy and Mr. Hays, and the many others, who are the acknowledged leaders of their profession, should and did have great weight. Perhaps I might here be allowed to express a little feeling of pride, and at the same time I think we all ought to feel proud, that our University was the first in the world to set forth a fully thought-out scheme for the education of railroad men.

We cannot, of course, expect to meet with complete success at once. We must be guided by the opinions of men like those who are present this evening. We are always ready to modify any of our work to meet what might be considered by men in active practice as a desideratum. May I therefore ask for your hearty co-operation and aid in the development of this great work. Railroad work is changing all the time. There is a danger of practical men becoming somewhat fossilized at the university. If we are to keep up with the times, I would ask every one of you to send to Mr. Morgan, from time to time, any suggestions you may have to make on this subject of railroad education In weighing one subject against another, bear in mind that we have only a limited time at our disposal, and cannot, therefore, very well cover the whole of railway education in twenty-eight months. If you will, from time to time, give Mr. Morgan suggestions, he will, I am sure, most carefully consider them, and we shall do our best to meet your wishes. In this manner I think we shall secure success.

What I wish to impress upon you is the fact that the McGill University scheme is not a scheme based upon ideas of theoretical men, but it is a scheme based upon the combined opinions of practical and theoretical men in the highest positions.

I shall be very pleased to answer any questions on this subject, or in regard to the scholarship you are thinking of founding. Such a scholarship, I may be allowed to say, will be a great help to us, on account of the prestige it gives to the University. It will strengthen our hands, because in starting a new course there are always plenty of people prepared to throw cold water upon it, and when we meet with enthusiasts on the subject it helps us to continue our work with greater vigor, and a determination to make it a success.

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CONTENTS

A Town's Industrial Awakening - - - - - - 445
Advantages of a University Education in Railway Work - - - - - - - - - - - - 448
By Dr. H. T. Bovey.
Editorial - - - - - - - - - - - - 450
Follow-Up Systems Bring Results - - - - - 452
By Geo. H. Pedlar, Jr.
Daywork vs. Piecework - - - - - - - - 453
By D. S. Swinton.
Producer Gas Plants - - - - - - - - 454
Article II. By Emile Stern.
Milling Machine Attachments - - - - - - 457
By John Edgar.
Tricks of the Trade - - - - - - - - - 459
How to Gear a Lathe for Thread-Cutting. By F. E. Lauer.
Mechanical Reviews - - - - - - - - - 460
Making Drill Jigs.
Repairing a Fly-Wheel Arm.
Book Reviews - - - - - - - - - - - 461
Foundry Practice - - - - - - - - - - 462
Recent Foundry Development. By H. Pilkington.
Where the World's Nickel Comes from.
Uses of the Blower in the Foundry.
Practical Questions and Answers - - - - - - 465
Power and Transmission - - - - - - - - 466
Combination Relief and Back Pressure Valve.
Compressed Air Forges.
The Abuse of Valves.
The Burrows Steam Trap.
About Catalogues - - - - - - - - - - 468
Machinery Development - - - - - - - - 469
4-in. Motor Driven Machine.
Bench Miller and Milling Attachment.
Champion 14-in. Engine Lathe.
A Deck Caulking Tool.
Forging Qualities of Aluminum Bronze.
Alundum - - - - - - - - - - - - 473
The Latest Product of the Electric Furnace.
At the Noon Hour - - - - - - - - - 474
Industrial Progress - - - - - - - - - 475

WHY DO MUNICIPALITIES STAND STILL?

IT is not because they do not wish to grow. Nearly every town and village has a sleepy desire to expand and grow big and outrival its neighbors. People there would like to see industries coming, the town's limits expanding and property values increasing, but of course with no effort on their part whatever. Then why do all the municipalities in Ontario where a future for manufacturers is assured, and where opportunities are so numerous, not enlarge as would a well regulated and healthful business in times of prosperity? Apart from natural advantages the reason and solution lie with the citizens themselves. In most instances those who could and should help to build up the place in which they reside, and which holds their business interests, are either too engrossed in their own affairs or else entirely indifferent. Take town after town, and municipality after municipality in Ontario and this is found to be the case. The growth of the town is found to be in direct proportion to the public spiritness of the men who mould opinion and who take the lead in public affairs. This might be laid down as an axium and holds in the case of Ontario towns to-day.

Since our last issue we have had an excellent opportunity of finding out how interested the various towns in the province were in their own growth. In the November issue an editorial reference regarding a United States manufacturing firms intending to come to this country to manufacture was suplemented by a post card sent out to about fifty cities and towns calling attention to the fact. Of these at the time of going to press thirty-seven showed no interest in the subject whatever. This being all the more surprising since the industry in question was not looking for a bonus. It was noticed of the thirteen who did reply the quickest and most businesslike responses were from places having a live Board of Trade. Before the issue had been many hours off the press and before the card calling attention to the opportunity was sent out the secretary of the Board of Trade of one of the most progressive and enterprising towns in Canada was in our office to get full information. The spirit displayed by the Board of Trade in this instance has been characteristic of its policy for years past. The result is that a manufacturing town has been built up, the result of the citizens own efforts that for stability and general beauty is not surpassed anywhere in Canada.

In direct opposition to this spirit was that shown by another town whose reply came in about two weeks after their attention had been drawn to the matter. It was answered by the town clerk, who, of course, had to bring it before the town council before even making a reply or even asking for further information. Had there been in that town a live up-to-date Board of Trade the matter could have been taken up immediately, the information secured, and, if necessary, a representative sent to interview the manufacturers in question. The local newspaper comes out announcing the fact that the town is just the place for that industry and then everybody falls asleep and no further action is taken.

The town whose Board of Trade secretary was first to seek the information has a splendid opportunity of securing this industry. The leading men of this latter town have at all times joined hand in hand for the town's welfare, have sought at all times to build up the town in every legitimate manner possible and have themselves created for the most part the town's many promising and flourishing enterprises.

About two years ago the town of Welland hardly realized it had a future. One happy day in the town's history

the town folk woke up to the fact of the town's possibilities and realized its advantages for industrial concerns. They lost no time in getting together and within 18 months worked with such success as to create a record in industrial progress in Canada.

The citizens of many a town may say, and it is often heard by those unwilling to make an effort in their town's behalf that inasmuch as we have nothing to offer what is the use of trying to compete with places having greater natural advantages. If those same citizens spent only a fraction of the time now spent gossiping in the back room of the local drug store in planning for the town's future and in themselves creating industries they would have no complaint to make regarding their town's progress and development.

POOR CALCIUM CARBIDE.

IN a recent weekly report of the Dominion Commercial Agent at Birmingham, Mr. F. D. Ball complains of a poor quality of calcium carbide received from Canada. In a letter received by him from a buyer in England it was stated that many users in that country would prefer buying from Canada instead of from Norway and Germany, but unfortunately the quality of the goods was not up to the standard required. Mr. Ball states "This is now a matter for the Canadian manufacturer to look into. There is one thing the British want and that is a first-class article and all Canadian exporters of whatever class of goods should bear that in mind. British naturally wish to buy their goods as cheaply as possible, but they will not buy an inferior article because it is a shade cheaper. This fact cannot be brought home too strongly to all manufacturers in Canada. It has been repeated time and time again, but its very repitition seems to weaken its strength. Costly blunders have been made heretofore in the case of dairy products and apples and it is unfortunate that the manufacturers of calcium carbide in this country should have to be brought to task for the quality of their goods.

In taking up the question with a large consumer of calcium carbide in this country it was found that the complaint from Great Britain had not been without cause. In some instances it was found that the gas produced from the carbide was from 25 to 33 1-3 per cent. less than the standard amount.

This is a rather serious matter since the low quality of one line of good reflects against the entire industries of the Dominion. Manufacturers of calcium carbide in Merriton, Shawinigan Falls and Ottawa should state their position in the matter. While letting a statement of this kind go without challenge they are admitting the justice of the remark and at the same time placing themselves in a position of having the good name of all Canadian exporters injured by their action.

CAN THE EFFICIENCY OF THE SUCTION GAS PLANT BE INCREASED?

BEHIND the efficient and complete steam power plant of the present day are centuries of experimental work. The modern steam plant would be a wonder to the ancients, and it is doubtful whether Watt would recognize in it the development of the simple steam apparatus for which he did so much; but in spite of this the low efficiency of the modern steam power plant is a thorn in the side of the thinking engineer of the present day. It was in 1876 that the producer gas plant was first though of, and in 1878 the first producer gas plant was built by Dawson. The idea of a producer gas plant was suggested shortly after the invention of the Otto cycle gas engine, by the desire of a cheaper form of gas than that used for illuminating purpose. This plant was a pressure plant, and because of its complication and the attendance required, did not gain favor rapidly, although it is quite efficient. Between this date and 1895 little progress was made. In 1895 the first suction producer gas plant was made by Koerting Bros., Germany, and this started the development of suction gas plants, which are now made by numerous firms in Europe and America.

Tests made on these suction producers during the last two years show them to have a thermal efficiency of from 75 to 80 per cent., by thermal efficiency meaning the ratio of the heat units in the resulting gas to the heat units in the coal used in the production of the gas; and it was shown that the coal used in the producer per brake horse-power per hour available at the engine to be in the vicinity of 0.9 lbs. If one compares this coal consumption with that of the most efficient modern steam power plant he will be enlightened as to what suction gas plants and gas engines are doing. It is not to be expected that the coal consumption in actual practice will be kept as low as this because of the coal consumed in starting the producer.

If, then, due economy such as described can be obtained from suction gas plants after a development of only eleven years, is it not reasonable to suppose that an even better efficiency will subsequently be obtained? Upon investigating the losses in the plant and in the engine, one would be led to answer in the affirmative. The chief constituents of the gas are hydrogen, carbon monoxide, marsh-gas, carbon dioxide, and nitrogen. Of these the first three are the only useful constituents, carbon dioxide and nitrogen being inert gases. These inert gases increasing its heating value. Carbon dioxide is the result of complete combustion of carbon with oxygen, and in its formation coal is consumed to no useful purpose. This forms one of the sources of loss in the producer gas plant. The nitrogen comes directly from the air and the only objections to it are, that it absorbs heat from the producer, a good part of which is lost to the cooling water in the scrubber, and that it increases the volume of the gas for the same heating value requiring a larger engine cylinder for the same power than would be necessary if it were not present. It is reasonable to suppose that in future better air regulation may be obained so that there may be no surplus oxygen for the formation of carbon dioxide. Then will be eliminated one of the inert gasses and part of the other, since the air is responsible for the nitrogen. Another source of loss is the heat which the gasses give to the cooling water in the scrubber. At present part of the heat of the gas coming from the producer is utilized to generate steam and to superheat it; and in future it may be hoped that still more of this heat will be utilized to further superheat the steam and also to pre-heat the air blast and the coal in the hopper. In this way it may be possible to extract the heat from the gas to such an extent that but little heat will be left for cooling water, when the scrubber will act more as a washer than as a cooler. If the steam were superheated it might be possible to increase the proportion of steam to air when more hydrogen and less nitrogen would be obtained in the resulting gas. The exhaust gas from the engine might also be used to pre-heat the air blast and coal supply, thus increasing the efficiency of the plant. The remaining source of loss in the producer is through radiation, but this is a very minor one.

Follow Up Systems Bring Results

"Keeping Everlastingly at it Brings Success."

By Geo. H. Pedlar, Jr.

THE general idea of the "follow up," either by letter or by personal solicitation, over the counter or otherwise, is now recognized by all live business people, as being the essence of salesmanship. No up-to-date business man would think that he had served a customer fully, when, in answer to a question as to the price of a cake of soap, a pair of boots, or a sixty-six foot tape, he should say 5c., $3.00 or 75c., as the case might be, and let it go at that. That would have answered, perhaps, once upon a time, because there may have been no other cake of soap, pair of boots or sixty-six foot tape carried in stock nearer than Hogs' Hollow, seven miles down the pike.

To-day, however, conditions are different—so very different that one has to say much more than the mere giving of prices, and the things you say, determine even more than the price quoted, whether your customer purchases or not, because it is sure true, that almost anyone will pay 25 cents or 50 cents or even more, in addition to the price he figured on paying, provided what is told him by the salesman, sounds good to him.

Every business house must determine for itself, what is proper to say in a follow-up as well as how and when to say it. We adopted a crude follow-up, as long ago as ten years, which, as time has passed, has been closely watched as to results, until now we are as perfect as we know how, though always looking for better results.

Following up Letters.

With the receipt of a letter, we make our answer, as far from the general stereotyped style as possible. The letter gives the clue. In two days' time, we take up the same letter, and go after the prospective customer again, from another point of view, but still on the same subject. Then if, after a reasonable time, we have no response, we present the subject from some other point of view, because, while one argument might interest one man, it might take a much different one to interest another. Failing to get a reply of any kind, to this effort, we write a straight appeal, asking a reply. Generally, we have a response to this and it gives us a new chance for continuing the subject.

Sometimes, however, even this remains unanswered, but we do not stop there. Oh, no! The man may have gotten married in the meantime, and forgotten, for the time, that his barn ever needed a new roof. So we file his and our letters away—to give him a chance —and, in three months, take up the subject again. We get many orders from people after the "second round," and, as our business motto is, "Keeping everlastingly at it brings success," we could not very well drop any communication, until something definite had resulted.

Our customers in Canada are served from our warehouses located in most of the principal cities, necessitating our maintaining a follow-up system in each office. But they all work as a unit, each adopting the same general scheme as outlined.

We believe in the follow-up idea so much, however, that a weekly letter is

G. H. PEDLAR, Jr., Oshawa.

sent from this office, to all agencies on one subject or another, appertaining to the business, and our letter on the follow-up system was :

In our business a man may write for prices with the intention of ordering some kind of building materials right away, and for some unknown reason his plans may be altered. He might have a death in his family, or sell his place, and buy another, or for a hundred and one reasons change his plans, but the point is, that having once received an inquiry from a man he should not be lost track of till you receive a definite understanding or order from him.

Inquiries cost money. Every post card you receive saying "Send catalogue and best prices" costs money, much more than you imagine very much more. For instance, the "ads" we are now carrying cost $500 per month. Suppose all told, we get ten inquiries per day or three hundred per month (and we don't) that is say $1.50 that each inquiry costs. One dollar and a half to get an inquiry. It's a lot of money, but it pays provided the inquiry is properly handled after received. It's alright for one to say that such and such a postal received is N.G. and calls for nothing more than a reply, and then to be passed up and forgotten. That's wrong. I have tried it myself and was very much surprised later on to get an order from the same man, who in the beginning inquired in the tone of a school boy. There is no rule to follow except the correct one, of treating them all as if they were from the largest concern in the world. One is very apt to slight a reply to a man rated at nil, while giving minute attention to a man of position. Nevertheless, one is just as apt as the other to use some goods. A "Follow Up" system is simple, and while involving some trouble—like anything else that's worth while—it pays without a doubt.

If you have not got a small card index let me know and I will get you one. If you have, this is being written first with an idea of giving you some slight idea of the cost of each inquiry, and second with the idea of impressing you with the importance of following up thoroughly. The most profitable business you can get is the business that comes in by mail. It's also the best, because you can write twenty letters a day at the expense and time of going personally to one man, and while the chances for orders solicited by mail are not to be compared with the chances of getting an order by personal solicitation, still the cost is not so great.

Letters Should Be Original.

The form in which letters are written is the basis of all successful mail order propositions. Every one agrees that the live business man of to-day avoids entirely the stereotyped form of business letter of fifty and even a dozen years ago. Don't say "Yours of the 6th inst., received and in reply beg to say." That's antiquated and does not serve the purpose. Throw it right into a man from the first word. Go right at your subject on the first line.

Ninety-nine inquiries give you some clue as to what the man had in mind when writing, and if it does, go after

that particular point on the jump. People are not interested now in anything that pertains to dead wood they want the meat.

Another thing. Don't trust to your memory. You may have the best memory of anybody in the world, but you will forget. Besides it doesn't pay. A man to make a success of his business now-a-days has enough to think of without cramming his head full of details. Who ever heard of the president of any company keeping his cash book in his head? It could not be done, and done correctly neither can a "Follow Up:' system.

Day Work vs. Piecework *

By D. B. Swinton, Montreal.

THE first authentic record of piecework, known to us, is when the Israelites in captivity under Pharoah were allowed their provisions in return for making a certain number of bricks per day. This system remains the fundamental basis of present day piecework, a man's efforts requiring him, when on piecework, to devote for his personal advantage, more energy than he would were he paid straight time.

The success of piecework as a shop principle depends largely on the amount of care and attention which the system receives from the foreman. Nothing can be more abused than improperly priced piecework, and the advantage of piecework can only be obtained when both employe and employer are taken into consideration when deciding upon the price to be paid.

In certain shops a system is in vogue which may give in a measure some satisfaction, but which for general purposes can hardly be recommended for general use. That is, in straight construction work a man is engaged to make a certain piece at a certain price, but this interferes with the elasticity of shop management and prevents the swinging around of work in the shop that is sometimes found necessary.

The system with which I am in touch and which apparently gives satisfactory results both to men and company, is as follows: While the company does not encourage a large percentage of gain in piecework, over day work, they permit a man a maximum gain of fifty per cent. on blacksmith work, so that a blacksmith paid at a 20-cent-per-hour rate can in a ten-hour day, with properly adjusted prices, make $3, or an increase of $1 over his time.

This applies particularly to a man conversant with this work and who, to make and warrant this increase, is willing to exercise more energy than he would were he working on a straight hourly basis.

In placing a man on piecework he is for all practical purposes being admitted to an active interest in the shop in which he is working, and as a certain article is supposedly worth a certain price to the company, he is assisting in the success of the shop by increasing the output of that article as well as financially benefiting himself.

In figuring on prices, I have always taken into consideration the actual amount of machine and manual labor required to make a certain article, the rate of the men performing the labor and the nature of the work. A man working on cold work scarcely merits the same return for his labor as one who is working on heavy forging, where his physical labor is made particularly hard on account of the heat which he has to endure. Then, again, the actual cost of production by day work should be considered, as there is no benefit to anyone concerned unless the cost of the finished product can be reduced when placed on a piecework basis.

After arriving at a figure which seems reasonable for all parties concerned, it is placed on record and the timekeeping department is advised of the price after it has been certified to by the master car builder. Care is taken to have the price figured out carefully as it is not considered creditable to a foreman to rectify his prices after they have been placed on record, although in a progressive shop where new ideas, tools, dies and machines are being constantly brought into service with a view of increasing the output and reducing labor, the scale of piecework prices existing prior to the introduction of an improved system should be carefully adjusted and when found necessary should be reduced so as to correspond with the improved condition.

In the Canadian Pacific Railway shops before any piecework price can be increased, reduced, or placed on record, it is most carefully scrutinized by the master car builder, who satisfies himself that the price is just for all parties concerned before he will authorize its issue.

The count of pieces is made by each charge-hand for his particular section and a report of the same sent in to the shop office, signed by the charge-hand, and after approval it is handed over to the piecework inspector who is in the employ of the auditing department and who keeps a record of the time, rate, price, and order distribution. He also keeps a check on the count, and should he so wish, may request a second count to assure himself that all is correct. Out of 220 men employed in the shop about 120 of them are working constantly on piecework. In the writer's opinion, the output of any shop will be almost doubled by placing, wherever possible, a price on any article.

The benefits to be derived from piecework are numerous, some of them being: Increased output; prevents what is commonly known as "soldiering," as when a man has to depend upon his own exertions for his day's pay, he will naturally put his best foot forward; shows up "dead men," as it can easily be seen when a man is working on piecework, whether he is doing his best; standardizes the work, as a man who is placed upon a particular job will rapidly develop into a specialist, when he is allowed to use his judgment as to the best way to increase his day's pay; the work turned out by a piecework man has the benefit of being uniform; keeps good men in the shop, as the steady men in a shop are the piecework men who, through fear of being replaced on their piecework during their absence, lose no time, unless justified in doing so.

Care should be taken and judgment used when it is found necessary to cut or reduce a price as it is a well known fact that all men are not to be measured with the same rule and it would not be justice to a man to reduce his price on piecework, simply because he has through using his head, brains and body, been able to exceed the output of his predecessors on the same class of work. Indiscriminate price cutting is an evil to be avoided as much as possible.

Care should be taken in the actual count being returned and if men are made responsible for their work and obliged to replace any rejected material it will force them to turn out only work that is satisfactory.

* Discussion at the Railway Master Blacksmiths' Convention.

"You've been so prosperous this year you ought to be very happy." How can I be happy when I haven't a thing in the world to growl about?"—Atlanta Constitution.

Producer Gas: Its Production and Application

A Series of Articles on Producer Gas, Its Production and Application as Shown by German, French, English, and American Practice.

By Emil Stern

ARTICLE II.

HAVING dealt in the October issue with the description of the old Pressure Gas plant and with the history of the invention of the Suction Gas Producer, we showed how gradually the way from the pressure to the suction type was made.

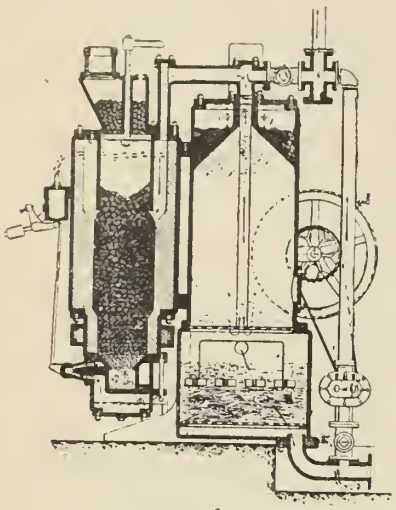


Fig. 5. The "Delassue" Producer.

The suction gas producer has gained nearly the whole field and it is astonishing how trifling the changes have been that different constructors have made after the year of the invention 1901. Not a single one shows a difference in the principle and after all it is just a matter of experience to find the right proportions only and a strong and reliable design.

It would fill books to show and to describe all of the constructions that have

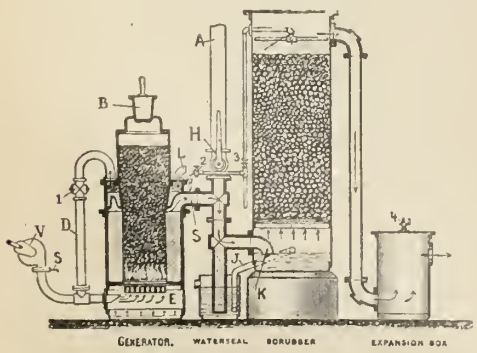


Fig. 6. "Acme" Producer.

made their appearance on the market within the last five years.

Principle of Producer Plant.

The gas making process the principle of all the suction gas producers for power purposes is the following: The gas engine works as a suction fan on the plant driving its suction stroke, producing a vacuum in the plant. The result of this temporary vacuum will be that air will be sucked into the plant wherever it is open. There is a hole provided in the producer for this purpose. The Oxygen (O) of the air sucked this way into the producer will try to burn the coal and to combine with the carbon (C) of the coal to form carbon dioxide (CO_2), but as the air supply to the producer is kept insufficient it will only form a little Carbondioxide (CO_2) most of the resulting gas will be Carbomonoxide (CO).

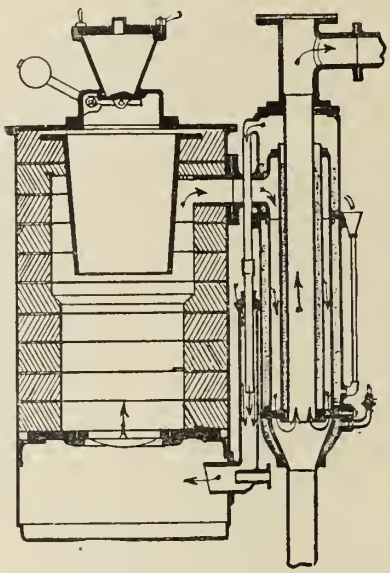


Fig. 7. The "Vedy" Producer.

Carbomonoxide is a very powerful and strong gas, while (CO_2) Carbondioxide or Carbonic acid has no heating value at all.

The gas when it is generated is as hot as the incandescent fuel where it is produced from, but it has to be cooled down for the use in gas engines. This sensible heat was wasted in the old pressure plant, now we use it to raise some steam in a water vessel or vaporizer so that two important actions are done at the same time, the gas gives off its heat and some steam is generated. This steam is used for the following purpose. The steam pipe opens into the ash pit so that the steam cools the grate and then gets into the incandescent fire. The intense heat changes the water particles into hydrogen and oxygen. The oxygen is used as the oxygen of the air partly to burn the coal to keep the intense heat necessary to break the water, partly to combine with carbon of the coal forming carbonmonoxide. The hydrogen and carbonmonoxide are the two driving forces of the gas engine. The gas leaving the producer and vaporizer is chemically ready, but there have apparatus to be provided to clean it from dust so as to save the expensive material of the gas engine.

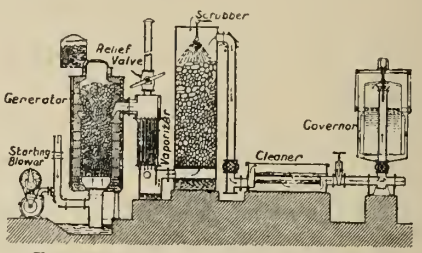


Fig. 8. The "Pintsch" Producer.

Different apparatus have been designed for this purpose. The most common feature is a wet scrubber filled with coke, water running from the top to wash the gas which enters the scrubber at the bottom. As the gas leaves the scrubber more or less in a wet condition, it will always be well to dry it in a purifier, usually filled with sawdust. After this general explanation it will be easy to understand the design of various producers showing special features of the same.

Various Styles.

There is considerable divergence of opinion with regard to the fuel support. The majority of makers supply fire bars, so fitted that renewals can be easily inserted without interfering with the lining of the producer. Many designers provide a wet ash pit so that the water vapor rising from this helps to keep down destructive temperatures.

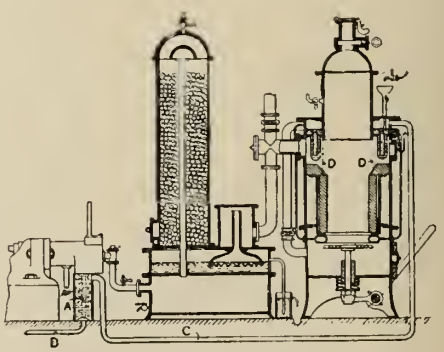


Fig. 9. The "Dynamic" Producer.

Fig. 5 shows the Delassue producer with a water cooler casting at the base of the full bed this forming the vaporiser.

Gas Outlet.

After leaving the fuel bed, the gases, before being conducted away from the generator and passed to the cooling and

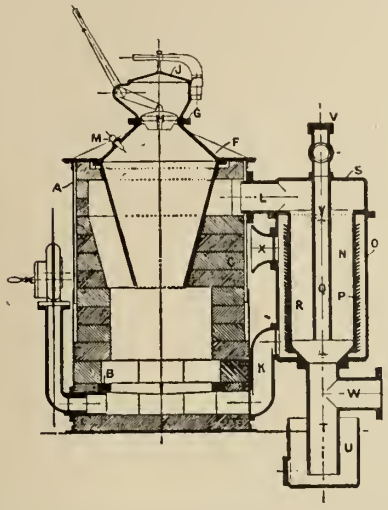


Fig. 10. The "Kynoch" Producer.

washing processes, are allowed to collect in the upper portion of the generator, and to circulate round the distilling bell. In many designs—as in the Acme producer, Fig. 6, they are made to pass under or through a dish of water before the final exit. Sometimes the outlet is placed a considerable distance above the fuel bed to allow a large quantity of coal to be distilled gradually within the generator—as in the Vedy producer, Fig. 7, and, as the pro-

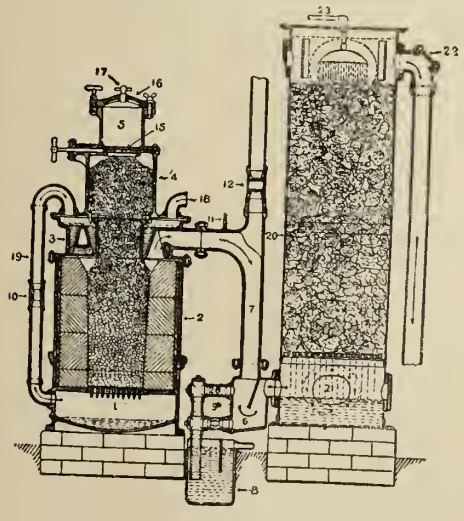


Fig. 11. The "Tangye" Producer.

ducts yielded during the process expand downwards through the coal, the great heat of the rising gases converts the tarry vapors into fixed gases and in this way, with efficient washing in the scrubbers, the tar difficulty is reduced to a minimum.

Messrs. Pintsch (Fig. 8), instead of allowing the gas to circulate round the distilling chamber provide an annular collecting space about half-way up the generator. This method has much to commend it. Being entirely formed by the firebrick lining there is no burning away of metal, while the entire heat of the gas is available for the previous coking of the coal as it settles down through a restricted area. In this method there are no cold surfaces within the generator to favor the deposit of soot, while the small portion of heated firebricks exposed to both the hot gas and fuel ensures that distillation can only be a slow process and that no excessive yield of volatile gases is possible, even after a heavy charge of fresh fuel.

The Dynamic gas producer (Fig. 9, above) is fitted with a gauge screen around and above the fuel. The screen filters the gas and holds the solid par-

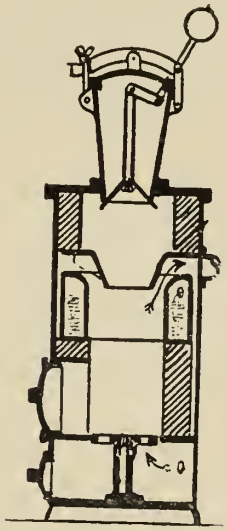


FIG. 12. The "Davey-Paxman" Producer

ticles within the generator until converted.

When comparing the designs which have as a feature a large cast iron "distilling" bell above the fire, it is to be observed that, to avoid the drawing up of incandescence through one portion only of the fuel, and especially when light loads only are being served, many manufacturers build the firebrick lining so that the gas is diverted from a straight path from fire to gas outlet, as in the Kynoch producer, Fig. 10.

Charging Hoppers.

There are a great variety of hoppers, nearly every maker seemingly having his own device. With one or two exceptions they have double valves, permitting recharging during operation of the plant without admission of air.

The valve at the base of the hopper is operated in many ways. In some French plants a pivoted false bottom is used, which upon the movement of a lever horizontally, swings aside (Fig. 1). In normal operation of the producer this sliding door is held to its seat by a spring sufficiently strong to withstand the weight of the fuel admitted to the hopper.

A similar slide differently actuated is

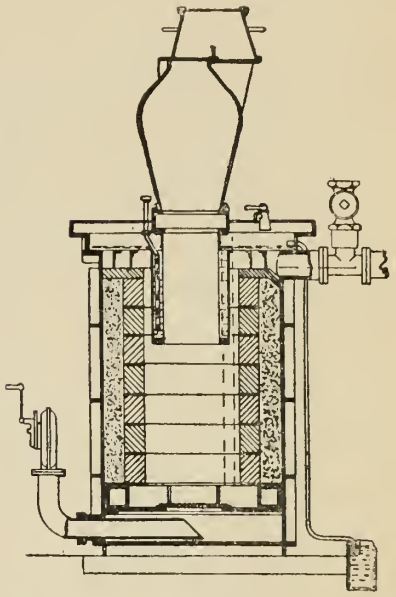


Fig. 13. The "Crossley" Producer.

shown in the Taylor generator, but in this example the position of the lever has to be carefully fixed to keep a tight joint.

The Tangye slide (shown in Fig. 11) is directly operated by a T handle, and is distinctly preferable to the two methods previously noted. The slide, however, must be nicely arranged to work freely without air leaks, and even with

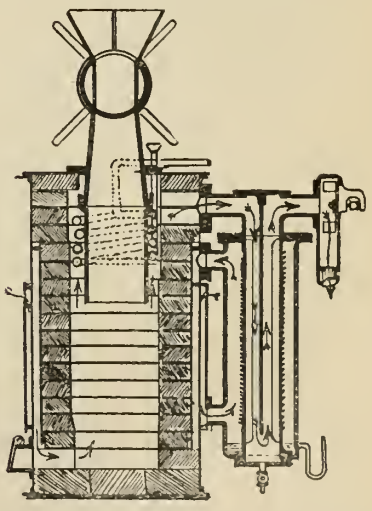


Fig. 14. The "Industrial" Producer.

care it is sometimes impossible to avoid jamming a piece of coal between the top and bottom faces of the fixed portion and the end of the sliding shutter. Especially is this liable to occur when the distilling chamber is previously well filled and the hopper is charged and

emptied without regard to the height of the fuel already within.

Mitre valves loosely hung above their seats and operated by a lever interior to the hopper are commonly used. (Fig. 10.) Their use entails rather more air admission with the fuel, however, as, to allow lifting from the seat, the hopper cannot be filled compactly.

Similar valves held by balance weights against a bottom seating have several advantages (Davey · Paxman producer, Fig. 12). The hopper can be completely filled and air excluded without interfering with their operation while, swinging suspended from their supports, they guide the fuel in this deseent and can be brought to their seats even if the hopper has been carclessly overfilled.

Charging slides, however, have an advantage over valves in that a poking tool can be inserted. at will right through the generator to the firebars—a central hole giving access all round the fire. With suspended valves, it is

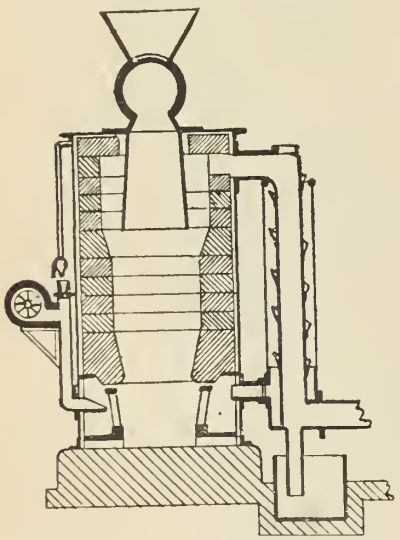


Fig. 15. The "Mersey" Producer.

necessary to provide at least one poking hole in the side of the casing below the feeding hopper, and unless two or more holes are provided circumferentially in this position, very little poking can be done. When clearing out at week-ends the swinging valves somebar.

what restrict the use of the clinkering

In place of slides or valves a revolving hood is adopted by a few makers (Cressley, Fig. 13, Pintsch, Fig. 8). To keep these in easy working order demands a little more care, otherwise they have advantages in many ways, as will be apparent from the remarks made previously.

Several makers are now adopting a cylindrical valve which, once filled and afterwards rotated, empties its contents into the generator, and with continued movement, again resumes the "charging" position. For clearing out purposes the charging cylinder can be entirely or partially removed (Industrial Fig. 14, Mersey, Fig. 15, Watt, Fig. 16).

Hopper lids, by some makers are very

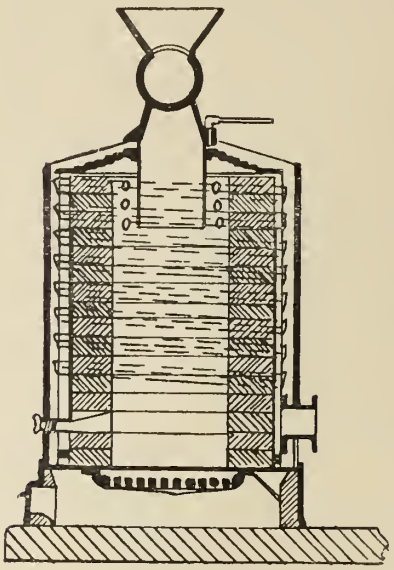


Fig. 16. The "Watt" Producer.

carefully clamped to their seats, while others trust to a good joint being made by the lid's own weight. The latter seem to answer every purpose, and, when suspended by a link from an overhanging swinging beam, fitted in a socket upon the rising hinge prineiple, there is a minimum of trouble involved. (Dowson, Fig. 17, and others.

A recent invention is intended to replace hand stoking by an automatic device operated by means of a piston subjected more or less by suitable adjust-

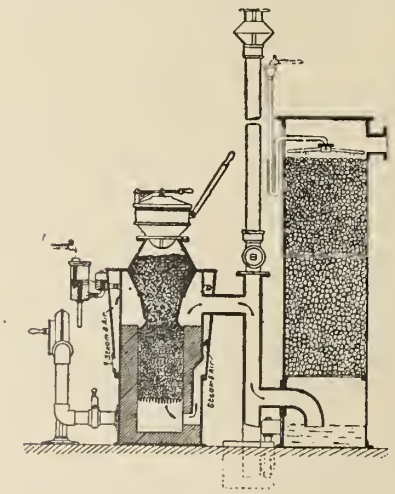


Fig. 17. The "Dowson" Producer.

ments to the rise in pressures in the pipe connecting the exhaust chamber with the open air at each exhaust stroke of the engine, (Griffin, Fig. 18). The piston is spring loaded, to ensure its quick return, and a ratchet movement causes a worm and work wheel to rotate a cylindrical feeding box. This box is divided into compartments of such dimensions that only a small quantity (about 2 lbs. of coal) is fed into the producer at one time, and it is claimed that, as the engine takes more or less explosions when doing its work, so does the automatie fuel feed accomodate itself to the corresponding coal consumption. The inventor, Mr. Griffin, of Bath, claims that the device is a great success, that the fire is maintained at a uniform depth under varying load conditions, and that it is possible to work with a clear fire and thus to take advantage of a larger proportion of the sensible heat of the fire and gases for the evaporation of water.

PREPARE FOR A HARD WINTER.

That the coming winter is going to be the hardest one for the past twenty

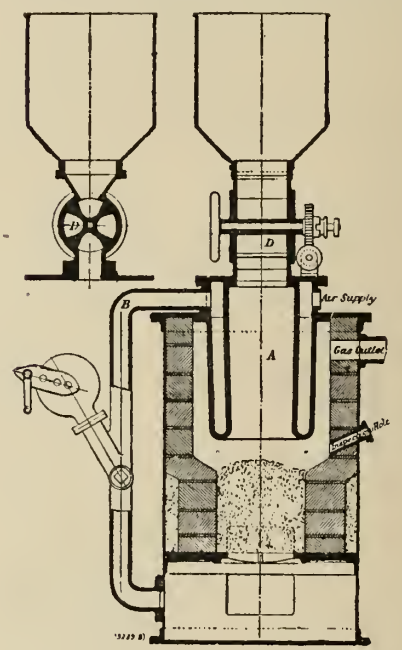


Fig. 18. The "Griffin" Producer.

years there is an abundance of signs to show, says an exchange, and among them may be mentioned:

The corn husks are a foot and a half thick, and all the stalks lean to the west.

The geese, ducks and chickens are growing a coat of fur under their feathers, and are rubbing borax on their feet to harden them up.

All the one-eyed owls are leaving the country a month earlier than usual, and the bob-tailed squirrels are laying in sweet potatoes, as well as nuts, for winter provisions.

The farmer who has taken the trouble to investigate has found that all the toad stools on the old logs have wrinkles in them. The last time that this happened we had winter weather that froze the handles of plows.

Milling Machine Attachments.

THE UNIVERSAL SPIRAL HEAD.—By John Edgar

BY the judicious use of the many attachments that have been devised for the purpose the variety of different operations that a milling machine may be made to perform is greatly increased. With these attachments a universal milling machine can handle any conceivable piece of work and be used in the solution of many a hard problem.

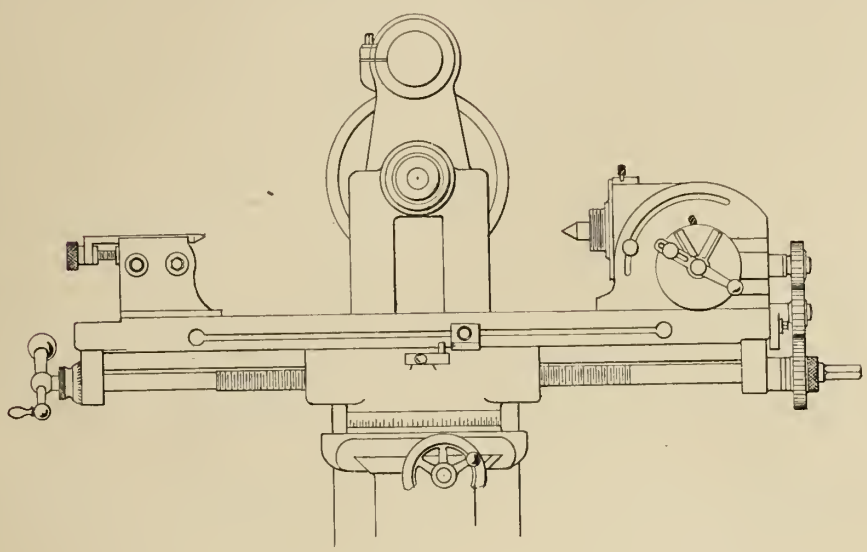


FIG. 1.

Some Attachments.

Among the attachments that have been adapted to the milling machine we may mention, the universal spiral head, the plain spiral head, the plain index head, the plain centre, the multiple centre, the tilting centre, the vertical spindle attachment, the angular milling attachment, the universal milling attachment, the rack cutting attachment, the worm gear hobbing attachment, the high speed milling attachment, the rotary milling attachment, the slotting attachment, the taper milling attachment, etc.

Description of Head.

The most common and the most used is the universal spiral head. This attachment is furnished regularly with all universal milling machines and may be considered an component part of the machine, but it is really an attachment and as such it will be treated in this and the following articles bearing on its construction and use.

In principle the spiral head is a device by which the work operated on is made to revolve about its own axis by suitable mechanism and if desired can be given a movement at the same time in a direction parallel with its axis producing on its surface, if a cutter or tracing point is applied to same, a helix which may be given any lead or, pitch within the limit of the range provided by the change gears.

The universal spiral head is a spiral head in which the axis of the work spindle may be swiveled in a vertical plane throughout a range usually greater than that of ninety degrees.

The universal spiral head is used in the process of cutting gears either spur, bevel, spiral or worm gears, in milling the flutes in cutters whether straight or spiral, in indexing work of all kinds, and in general tool work of that character.

In order that the operator may obtain the best results in its use he must know thoroughly on just what principles it is based and the general construction of the head together with the method used in figuring the possible combinations of gears and the use of the index plates in making accurate divisions.

The universal spiral head is always accompanied by a tail or foot-stock which is of some peculiar construction allowing its spindle to be raised or elevated so as to support the tail end of the work driven by the head spindle centre when such work is held in an angular position. Figure 1 shows a front elevation of a universal milling machine fitted with the universal spiral head and foot stock. The head is always used in the position shown, i.e. at the right hand end of the table, where it is used in connection with the lead screw which acts as a driver to actuate the work spindle in cutting spirals, in cases where spiral cutting is desired ; but if the head is used only as in index head it may be placed in any position along the table as may be most convenient. The foot stock is set along the table in a position corresponding with the length of the work.

In figures 2 and 3 the head is shown

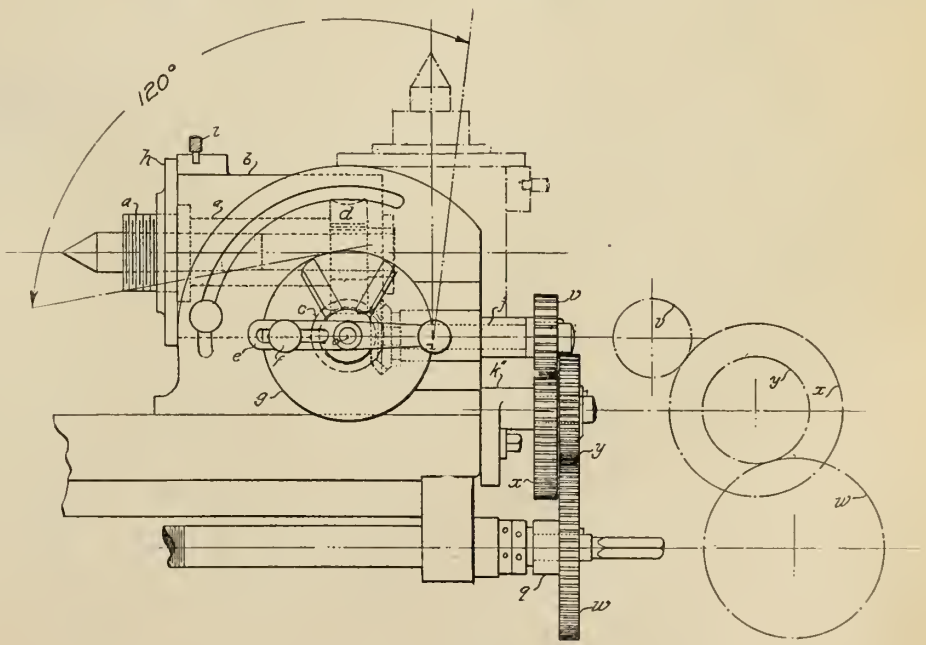


FIG. 2.

more in detail ; Fig. 2 being a side elevation and Fig. 3 a rear view. The internal mechanism is shown dotted in,

in the figures and consists of the members as described in the following.

Adaptation and Capacity.

The work on revolving spindle (a) of the head is carried in the swivel block (b), which is swung on trunnions so that it may be set at any angle within certain limits which are usually 15 degrees below the horizontal and 15 degrees beyond the vertical position making a sweep of 120 degrees which is ample range to handle the most complicated case that is liable to present itself. Some heads are made so that when fitted for indexing only, the complete circle of 360 degrees may be swept by the spindle but very little advantage is obtained by this extra degree of range. One of the conditions of the requirements of the universal spiral head is that the spindle may have a working position any where within the range of the arc of inclination. In order that this may be accomplished the connection between the spindle and the screw from which the former takes its motion

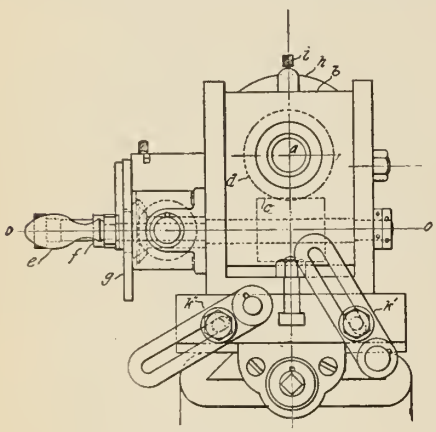


FIG. 3.

must at some point in the train be centred about a swivelling member in such a manner that the motion of the spindle is not interrupted. In the design shown this is accomplished by making the centre of the trunnions concentric with the axis of the worm used to drive the worm gear keyed to the rear end of the spindle. This cutter is (o) and the worm is indicated by (c), the worm gear by (d). It is easily seen that motion may be transmitted through the worm to the spindle with the latter inclined in any position in a vertical plane.

For the purpose of making divisions only, the head is complete when composed of those parts just described, no other parts being necessary since the revolving of the spindle a fractional turn is all that is required at each indexing. In order that the process may be more accurate and certain the worm shaft is extended and a crank (e) is placed on end of same, this crank being provided with a detent pin (f) which is so made that it may be dropped into holes in an index plate (g). The holes in the index plate are equally spaced and a number of plates are provided with different numbers of these holes drilled in the face of same. This gives a large range of divisions that may be made with a head so equipped. The number may of course be indefinitely increased by increasing the number of holes in the plates.

The worm gear (d) is made, in most heads, with 40 teeth and the worm a single threaded affair giving 40 turns of the worm or index crank to one turn of the spindle or worm gear. This may be considered standard practice.

From this we see that in order to index for 40 divisions, such as 40 teeth in a gear held in the work spindle,—it is only necessary to give the crank a series of 40 complete revolutions for eighty divisions, a series of 80 half turns would have to be made or in a more technical language we take a plate that is drilled, say with 20 holes and turn the crank through 10 holes for each division. This is what is known as plain indexing and is the most common form of obtaining accurate divisions of the circle that is in use. There are several others which will be taken up later on.

In order that the plates may be limited in number and yet cover as large a range of divisions as possible, there is need in the careful selection of the number of holes in each series. This has all been brought down to a standard by the builders of these heads, so that a series of 18 circles, each having a different number of holes, which are as follows: 15, 16, 17, 18 ,19, 20, 21, 23, 27, 29, 31, 33, 37, 39, 41, 43, 47, 49, usually arranged on three plates, though in the latter models the plates are made much larger and drilled on both sides, making it possible to place the whole series on one plate which is reversible, the side being used that has the desired circle. The circles are numbered so that it is not necessary to count the number of holes they contain, making it much more convenient than it would be otherwise.

Index heads and spiral heads are always accompanied by an 'index table,' which gives the different divisions that may be obtained with the equipment furnished, and reads as follows:

No. of divisions.	No. of holes in the index circle.	No. of turns of the crank.
10	any	4
11	33	$3\frac{21}{33}$
12	39	$\frac{13}{39}$
13	39	$3\frac{3}{39}$

A table of this kind reads like so much Dutch to any one not initiated into its mysteries, but it is in plain English, as follows; for 11 divisions,, we make three complete turns of the crank and then advance the fractional turn of 21 holes in the circle marked 33. The whole number in the third column always indicating complete revolutions of the worm or crank, and the fraction the part turn as indicated by the numerator which gives the number of holes, this fractional turn is to cover the denominator showing the circle in which the numerator is to be taken. These tables give the ordinary divisions obtainable with the three index plates mentioned, and will give readings for all divisions up to 50 all even and those divisible by 5 up to 100 and most numbers up to 360.

When it is desired to obtain a division not shown on the table, we may find the number of holes required in the plate, and the manipulation of the crank by very simple reasoning as follows:

Since the worm gear has 40 teeth and

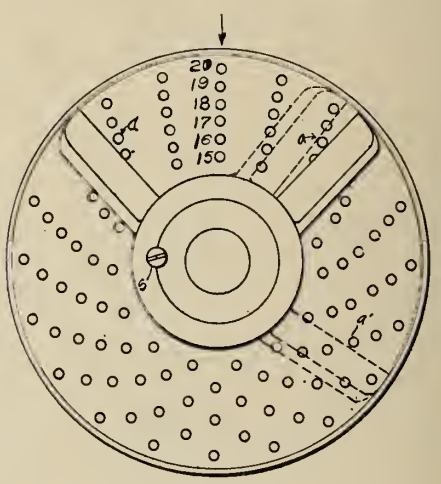


FIG. 4.

the worm a single thread, their ratio is 40 to 1, and therefore, it takes 40 turns of the crank to make a complete revolution of the spindle, in order that the spindle may make but a fraction of a revolution we must turn the crank a fraction of 40 turns; the actual number being found by multiplying the fractional turn of the spindle by 40. For example, let it be required to divide a gear blank into 73 divisions. We have by above $1\text{-}73 \times 10 = 10\text{-}73$ as the number of turns of the index crank, and such a division can be obtained by taking 40 holes in a circle having 73. 73 being a prime number it can only be obtained by special process to be explained later on.

The process of advancing the crank a given number of holes in a circle of a certain number would be rather inconvenient and rather uncertain, were it necessary to count the number out at

(Continued on page 481.)

Tricks of the Trade

Everybody is invited to contribute to this page. Send in your ideas, odd jobs you are doing, and anything of interest to fellow-workmen. Remuneration will be made for such contributions. [Ed.]

HOW TO GEAR A LATHE FOR THREAD CUTTING.

By F. E. Lauer

THERE is a constant ratio between the threads to be cut and the pitch of the lead screw, and that is easily obtained by dividing the pitch of the lead screw into the number of threads required, when the number of that is easily obtained b¼ dividing the lead screw, and when the number of threads is less than the pitch of the lead screw it is divided into the pitch of the lead screw as for example—16 threads required to be cut, 16 divided by a four pitch lead screw $=16\div4=4$ and again 2 threads are required with a 4 pitch lead screw, then 2 is divided into 4 giving a ratio of 2 to 1, when the number of threads required is greater than the lead screw, that is to say a finer pitch, the larger gear or gears are driven or placed on the screw and when the number of threads is less than the lead screw the larger gear or gears are the drivers or placed on the spindle. When the ratio is obtained it is only necessary to multiply both terms of the fraction by a figure that will raise the smallest term of the fraction to the number of teeth that is in the smallest gear, as for example 8½ threads is required to be cut, with a 3 pitch lead screw,

$$8\tfrac{1}{2}\times3=\frac{17}{2}\times\frac{3}{1}=\frac{17}{2}\div\frac{1}{3}=\frac{17}{6}\text{ and}$$

$$\frac{17\times4}{6\times4}=\frac{68}{24}$$

68 gear on screw

24 gear on spindle

or $\frac{17}{6}=2$ 5-6 ratio, snd 24×2 5-6 $=68$.

If the gears are not obtainable change the figure four to anything that will give the required gear, example 14 threads required with a 4 pitch lead screw, $4\div4=3\frac{1}{2}$ ratio; now any gear 3½ times to 1 will cut 14 threads, take a 20 and multiply it by 3½ and that will give you 70, 20 on the spindle and 70 on the screw or take 24 and multiply by 3½ and that will give another set $24\times3\frac{1}{2}=84$, 24 on the spindle and 84 on the screw. Another example required to cut 2 threads with a 3 pitch screw $3\div2=1\frac{1}{2}$, now any two gears $1\frac{1}{2}$ to 1 will cut required thread as $30\times1\frac{1}{2}=40$, or $45\times1\frac{1}{2}=60$, or again $60\times1\frac{1}{2}=80$, so it can readily be seen that any of these sets will cut two threads thus, 30 an d 40, or 45 and 60, or 60 and 80; now as two threads is less than the pitch of the lead screw, the larger part is the driver and is placed on the spindle, and the smaller on the screw.

Required 11½ threads with a 5 pitch lead screw $11\frac{1}{2}\div5=\frac{23}{2}\times\frac{5}{1}=\frac{23}{2}\div\frac{1}{5}=$

$\frac{23}{10}\times\frac{3}{3}=\frac{69}{30}$ gear on screw, or $11\frac{1}{2}$ threads with a 4 pitch screw is gear on spindle.

$$11\tfrac{1}{2}\div4=\frac{23}{2}\times\frac{4}{1}=\frac{23}{2}\div\frac{1}{4}=\frac{23}{2}\times\frac{3}{1}$$

69 gear on screw,

$=\frac{}{}$

24 gear on spindle, or again $11\frac{1}{2}$ threads with a 3 pitch lead screw $=11\frac{1}{2}$

$$\div3=\frac{23}{2}\times\frac{3}{1}=\frac{23}{2}\div\frac{1}{3}=\frac{23}{2}\times\frac{4}{1}$$

92 gear on screw.

$=\frac{}{}$

24 gear on spindle.

Always remember to find the ratio by dividing the number of threads by the pitch of the lead screw, providing the number of threads is greater than the pitch of the lead screw, and if less than the pitch of the lead screw, divide it into the pitch of the lead screw. It would not be necessary to find the ratio at all for we could do it thus, 16 threads required with a 4 pitch lead screw.

$\frac{4}{16}\times\frac{6}{6}=\frac{24}{96}$ gear on spindle, or 7 threads required with a 5 pitch lead screw.

$\frac{5}{7}\times\frac{4}{4}=\frac{20}{28}$ gear on spindle.

gear on screw.

It is necessary to get the ratio, however, so as to avoid confusion when compounding gears for fine or very coarse threads, for example thus, required 20 threads with a 3 pitch screw

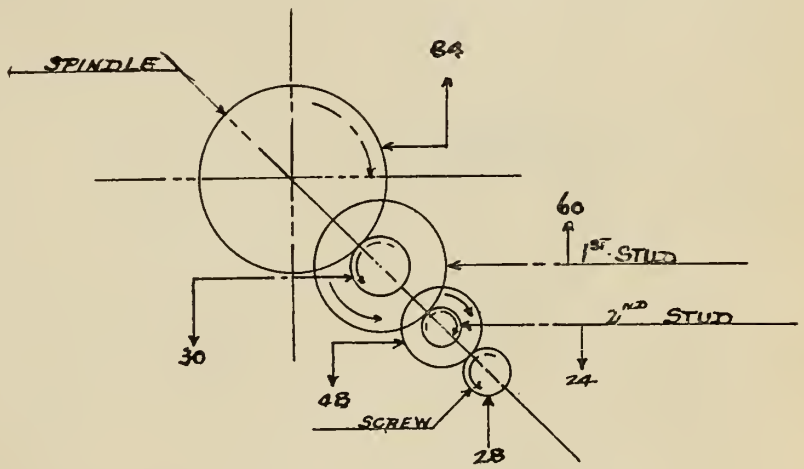
$20\div3=6\frac{2}{3}$; perhaps it will be found that we have no gear that is $6\frac{2}{3}$ to 1, then we divide $6\frac{2}{3}$ by anything that is sufficient to cut down the ratio to use the gears we have got.

$$6\frac{2}{3}\div3=\frac{20}{3}\times\frac{3}{1}=\frac{20}{3}\div\frac{1}{3}=\frac{20}{3}\times\frac{4}{1}$$

80 and 3 to 1 gives 30

$\frac{}{36}$ $\frac{}{90}$

and as the number of threads is greater than the pitch of the lead screw the small gears are the drivers and the large ones the driven and would be set us like this—30 gear on spindle driving a 80 gear on 1st stud, with a 36 gear driving a 90 gear on the screw. Suppose now we wish to cut a coarser thread than 1 per inch, then we find our ratio by multiplying the length of one turn by the pitch of the screw, and then compound thus, required one turn in 3 with a 4 pitch lead screw, then $3\times4=12$, which is our ratio, of course we have no gears that are 12 to 1, so we resort to compounding $12\div4=3$ which means that one set of gears 4 to 1, and one set 3 to 1, is required to cut the thread, and we get the following gears $\frac{4}{1}\times\frac{20}{20}=\frac{80}{20}$ and $\frac{3}{1}\times\frac{24}{24}=\frac{72}{24}$ now as one turn in 3 inches is courser than our lead screw, the large gears are the drivers and may be sei up thus—



Compound Gearing for Thread Cutting

80 gear on spindle driving a 20 gear with a 72 gear on the same stud driving a 24 gear on screw.

Going further and making a triple compound in event of not having the above gears we may add another stud and gear this way.

$12\div2=6$ and $6\div2=3$ and $2\times2=4$ and $4\times3=12$ our compounding must be right, and we may use the following gears: 2 to 1=24 and 48, 2 to 1=30 and 60, and 3 to 1=28 and 84 and, the gears would be set thus, in accordance with the sketch.

Mechanical Reviews

OPINIONS AND STUDIES WORTH NOTING

MAKING DRILL JIGS.

WE had a large number of drill jigs to make that could not be handled to advantage on any of the regular machines in the shop, so I decided to rig up a No. 5 Becker-Brainard vertical miller for boring the jigs.

A is the table on which the work is clamped, B is the cross slide, C is the scale guard, made of machine steel. It extends the full length of the table. The scale is secured to this guard at the most desirable angle. The overhanging ledge affords protection for the scale, lamp and vernier plate. The small T-slot that was formerly used for the feed stop is utilized to hold the scale guard. Directly under the ledge, a piece is fastened, forming a slot, into which the magnifying glass holder D is slid. It is so arranged that the glass may be used elsewhere or locked away when the machine is not in use. The glasses are swung on trunnions, and can be set at any angle by the small screw.

The bracket F fastened to the cross slide B supports the vernier plate G, and the lamp frame and the tube H also. The lower scale for the cross slide is embedded in the bracket I and knee J, and is protected by a loose slide piece K. The lamp tube is held by the plate L, and is supported at the outer end by the vernier bracket M. This is broken in the illustration to show the magnifying glass in position. The lower glass is mounted in the same way as the upper one.

Small incandescent lamps, 7-16 inch diameter by 2 inches long, are inserted in the tubes, the tube being slotted to direct a ray of light on the vernier plates only. The wires from the lamps run through the tube—part of which is shown—to a switch fastened to the side of the knee.

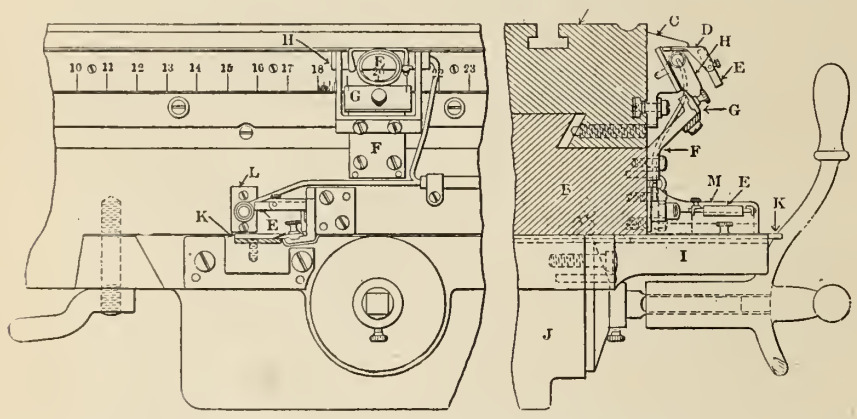
The scales are Brown & Sharpe make, graduated to 50ths of an inch with a vernier reading to 0.001. The table scale is about 42 inches long, and the cross-slide scale about 16 inches long, which gives a large range for jig work. The feed mechanism for the table and cross slide has been removed, not being required for this class of work.

The set of tools used with the machine consists of a reducing bushing, hardened and ground to receive a set of collets 3-6 to $\frac{3}{8}$ inch, a set of sizing reamers, to be held in the spring collets, a set of Morse taper-drill sockets, Nos. 1 to 4, an assorted set of boring bars, a center, a countersink and a feeler. All tools are held in place by the draw bar through the spindle, to the top end of which is fitted a hand wheel which greatly facilitates the handling of tools. The feeler is made about six inches long, hardened and ground to 7-16 inch diameter for about two inches of its length, and the rest of it is ground to 0.4 inch diameter. It is used to line up a job, also to locate the holes, registering from finished surfaces, half the diameter of the feeler being added to or subtracted from the reading, as the case may require.

If the feeler can be brought up to the straight surfaces in a jig to be registered from, it is not necessary to lay off the jig at all. The operator draws up a working chart, giving the location of the holes in decimals, so that the shifting can be done without any delay. If the feeler cannot be used, we simply put right-angled cross lines on the job, and use the center which is ground true, and run along the line, trying at different points and take a reading, then rub along the cross line taking the reading; coming back to both readings brings the centre directly over the intersection of the lines, regardless whether the intersection is seen or not. The location of all other holes on the same side is computed from the intersection reading. The countersink is first used, followed up by a short drill 1-32 inch smaller than the finished size, then the boring bar which bores within 0.0002 of finished size, and finally the sizing reamer, which is very slightly relieved. It is remarkable the way these reamers hold out. To my knowledge, a half-inch reamer has been used on about 500 holes in steel and cast iron, and still holds its size.

All holes set on angle lines are computed with the use of the sine and tangent tables. This in itself is a great improvement over the old method of using the faulty protractor. Holes on circular lines and different radii are bored on a circular table that is supplied with the vertical miller.

This machine has been in use a little over a year, and it gave such good results that another smaller machine was purchased, and equipped somewhat in the same way as the larger one, to take care of the smaller work. In conclusion I will say that it has brought about a decided change for the better in this branch of the trade. The present operator of the larger machine, who does all his own figuring, is a young man not yet twenty years of age, and is far from being a full-fledged machine.—W. A. in American Machinist.



Vertical Miller Fitted for Drilling and Boring Jigs

REPAIRING A FLY-WHEEL ARM.

WHILE moving one of the halves of a 17-foot fly-wheel, an arm was cracked at A (see illustration.) A consulting engineer suggested that the best method to fix the brake would be to braze the parts together. This plan was tried and proved successful, only the rim was distorted about one-half inch, as shown by the dot and dash line. In trying to remedy this latter defect the arm was cracked at BB.

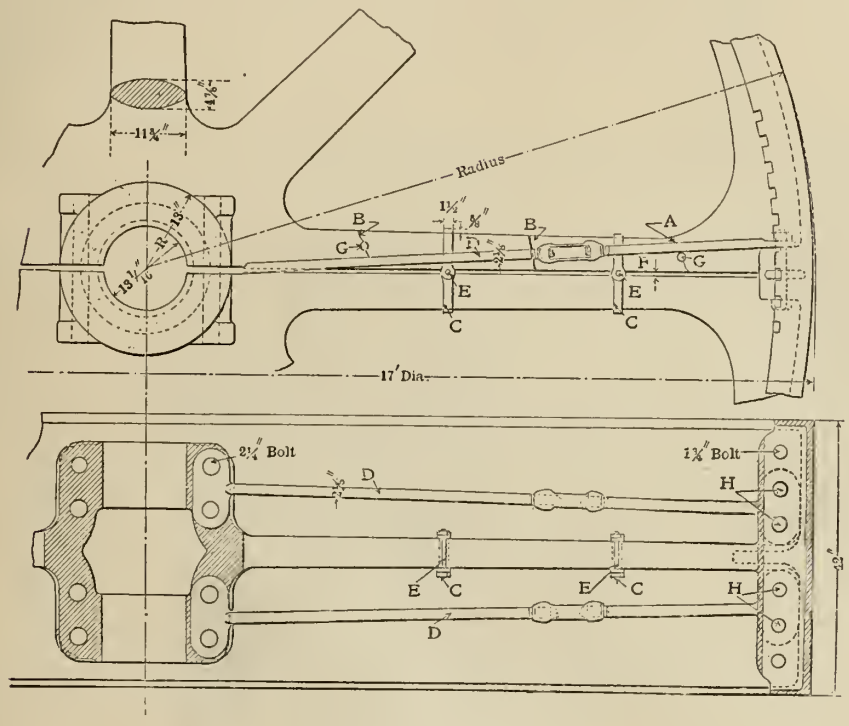
We finally fixed the break in this manner. Two wrought-iron rods were made $2\frac{1}{8}$ inches diameter, as shown at DD, and two pair of semi-rings, as shown at CC. First, the rings C were heated and placed in position and the pins E

driven in place ; the pins being slightly larger than the space F.

When the rings cooled off, they held the arm firmly in place. The pins G were then forced in position to help sustain the arm, and in order to see readily if the forces acting on the arm would displace same. The rods were put in position and by means of the turnbuckles the rim was drawn back to its right position.

Now to see if this manner of mending the arm is strong enough to resist the forces acting on it. The arms have to resist in tension the centrifugal force due to the rim and arms, the shearing at the hub due to the twisting moment and bending action considering each arm as a cantilever.

The tension strength of wrought iron is about three times that of cast iron of the same area. Assuming that the



Repairing a Fly Wheel Arm.

areas of the arms are strong enough to resist the centrifugal forces, one-half the area of arm, considering section an ellipse, is equal to

$$\frac{\pi \times 11\frac{3}{4} \times 4\frac{7}{8}}{8} = 22.5 \text{ sq. in.}$$

If the area of the rods is one third that of the arm, the rods will resist these forces.

⅓ of 22.5=7.5 sq. in.

Hence the area of one rod must be about 3.75 square inches. We used rods

R = radius of hub

R_a = radius of flywheel

N = number of arms = 7

I = moment of inertia of arm section

$$m_p = \frac{m\,(R - R_a)}{R \times N} = \frac{360{,}000 \times (120 - 12)}{102 \times 7}$$

$$= 45{,}380.$$

$$I = \frac{\eta \frac{7}{8} \times (11\frac{3}{4})^3}{64} = 385$$

Then the working fiber stress

$$f = \frac{\eta m_p \times y}{I} = \frac{45{,}380 \times 11\frac{3}{4}}{385 \times 2} = 700.$$

where y is one-half the width of arm.

There is another force acting due to the centrifugal force transmitted through the rods, that in the shearing of the bolts H. Calling the working tension strength of wrought iron 7000 pounds per square inch, a rod 2⅛ inches diameter will stand a load of 21,300 pounds. Assuming this load to be applied on the bolts H in shearing, on one bolt there will be a load of 10,650 pounds. The working shearing strength of wrought iron is 5000 pounds per square inch, hence, a 1¾-inch bolt will stand 10,500 pounds, nearly the assumed load on one bolt.

The factors of safety have been taken high in the above working stresses because the fly-wheel is in a paper mill which runs day and night throughout the week.

Another thing to be considered is the effect of the increased weight added to the fly-wheel acting as a counter-weight. It was thought at first that it might affect the engine, but it came exactly opposite the crank pin.

From this figuring it can be seen that the rods make the fly-wheel practically as good as new. It has been running for three years and up to the present there has been no trouble experienced nor any signs shown of its giving out.—Walter Bixby in Power.

BOOK REVIEWS.

THE A. B. C. OF PATENTS.—A synopsis of the patent trade mark designs and copyright laws in Canada and the United States with a short reference to patents in principal foreign countries. By F. B. Fetherstonhaugh, M.E. 32 pages, paper cover, price 50 cents, Toronto : The Carswell Co.

Volume 1 contains plain practical pointers to inventors, manufacturers and those interested in patents. It is intended to convey a clear idea of the law and rules relating to applications for patents, trade marks, designs and copyrights. It enables an inventor to intelligently understand what he is doing when applying for patent and what requirements are necessary in order to keep such patents valid. A praiseworthy feature of this book is its conciseness and clearness, showing at a glance the main features of the patent laws in the various countries and their requirements. To all interested in patents this book should not only appeal but be particularly valuable.

ELEMENTS OF GAS ENGINE DESIGN.—A reprint of a set of notes accompanying a course of lectures delivered at Cornell University in 1902, and notes taken from several of the American mechanical papers, by Sanford A. Moss, M.S., Ph.D. ; published by D. Van Nostrand Co., New York, in 1906 ; size, 6x4 inches with 197 pages ; cloth ; price 50 cents.

In this book all the fundamental principles of gas engine design are presented in condensed form, but no attempt is made to go into the detail mathematical and practical details. It is obviously intended to present in concise language and form the fundamentals of the subject with which all designers should be thoroughly familiar. The subject matter includes a general outline of the physics and chemistry of the gas engine, a discussion of gas engine fuels, a discussion of the action in a gas engine cylinder, and the finding of the size of the cylinder for a given power, the important principles of gas engine construction and rational formulas for most of gas engine parts, with constants derived from modern American practice.

Within its scope there is certainly a very complete and instructive book, and its conciseness is probably one of its best points.

Remember—It is only judicious workers who, knowing what are their powers, and using them with method and persisteney, make any real headway in life.

—Goethe.

Foundry Practice

MODERN IDEAS FOR THE TRADE.

RECENT FOUNDRY DEVELOPMENT.†

By H. Pilkington.

A DEVELOPMENT in furnace practice that has taken place recently, is the generation of power by means of the blast furnace gas engine. By this means very large quantities of power can be produced for use in operations quite external to the blast furnace itself. With the assistance of Mr. Thwaite I put down gas engines at Sheepbridge Works so far back as 1899, by means of which power was generated from blast furnace gas to operate a large new pipe foundry, and to-day the engines which, however, did not continue their operations. There is an enormous field for development in this direction, and the association will see a very notable installation at one of the works they will visit during their stay at Middlesborough.

By the use of blast furnace gas in internal combustion engines, there is a very great economy of gas used, the consumption being only about 110 cubic feet per I.H.P. developed, as compared with four or five times that quantity

Foundry Installation of Sturtevant High Pressure Blower.

power required for the production of some 600 tons of pipes and castings per week and the machine shops connected with them is wholly produced by means of blast furnace gas; the furnaces furnishing not only the power but the iron as well. This was probably the first successful installation for power production from blast furnace gas in this country. The small engines installed by Mr. Riley at Glasgow was indeed previous to this, but was used for electric lighting. There were at least two other

† Extract from President's Address before the British Foundrymen's Association, Middlesborough, Eng.

when used by means of steam boilers and steam engines.

As the average blast furnace produces about 170,000 cubic feet of gas per ton of pig iron produced, it will readily be seen what enormous sources of power are available. If the power required for the blast furnace operations were produced by means of internal combustion engines, probably half the gas produced could then be utilized for the production of power for other purposes. This suggests that in the future blast furnaces will become as it were, gas producers to plants required for turning pig iron into finished products, and that all finishing plants of whatever character in future, will be incomplete without blast furnaces to supply the requisite power to drive them.

This evolution would appear to be quite natural one when applied to the large iron and steel works of this country, some of which it will be our privilege to visit in Middlesborough, but to those who are also connected with foundry work in its largest developments, it appears that the application of this source of power will be by no means confined to steel works, but will also be applied generally as it has been, to foundry operations.

An ideal plant for large and heavy foundry operations might be described as having blast furnaces as its essential central factor, making pig iron, and producing gas in sufficient quantities to supply all the power required, the power being generated by means of gas engines working on the blast furnace gases, and either driving the machines direct, or generating electrical power and transmitting it to the various shops. All the foundry stoves could be heated with blast furnace gas. The pig iron could be run into ladles, passed through a mixer, kept hot by blast furnace gas, and the metal for the castings taken

from the mixer direct, without the intervention of a cupola in any shape or form ; thus, no fuel would be used about the plant except that put into the blast furnaces themselves for producing the pig iron. No electrical smelting plant of any kind could ever possibly compete with a plant of this nature. Pig iron used direct in this manner for making castings is an indefinitely superior metal in every way to that melted in cupolas, it is much softer and has a lower content of sulphur and manganese than the re-melted iron from the same stock.

The heavy increase in the production of iron at blast furnaces in recent years, has naturally reduced the cost of labor required to produce it, and this has been still further reduced by the almost enforced necessity for the mechanical handling of such large quantities of materials in a given time. In the case of pig iron, this has led to its being handled molten by means of ladles, either in connection with a mixer or a casting machine, or by handling it cold by means of electric cranes and breaking machines.

The most striking mechanical development, however, has been in the handling of the materials charged into the furnace top. The ores and fuel are dropped from hopper bottomed wagons by gravity into bunkers, from these they are also drawn by gravity into electrically propelled trolleys upon which they are weighed ; they are then delivered by these trolleys to the furnace skips into which they are dropped again by gravity. These skips are on an incline and are drawn electrically to the top of the furnace, where the materials are automatically dumped into the hopper placed over the top of the bell. There are no men on the top of the furnace, all the operations of hoisting and bell lowering being governed by means of levers operated by the trolley man at the foot of the incline.

With regard to the pig iron itself, perhaps the most notable development of recent years has been the application of the new science of metallography to the examination of the internal structure of the iron and the revelation it has made with regard to its different crystallizations according to the way it has been cooled down from the molten to the cooler state. May I point out with regard to this development that the examination of pig iron, by means of the microscope in order that we may examine its crystallization, is only a development of the judging and grading of it by fracture, the one is done by means of the microscope and the other by means of the naked eye. As there is a paper on the grading of foundry iron I will make no further comment except to say that it still appears that not only must the analysis be taken into account, but also the crystallization.

WHERE THE WORLD'S NICKEL COMES FROM.

ONE of the most valuable metals of commerce is nickel. Gold is where you find it—and so is nickel. Up to the present time, nickel is found only in two places—eastern Australia and in the region of Sudbury, Ontario. These Canadian nickel mines were discovered by accident, and for years went begging for recognition—no one seemed to know the metal had any value.

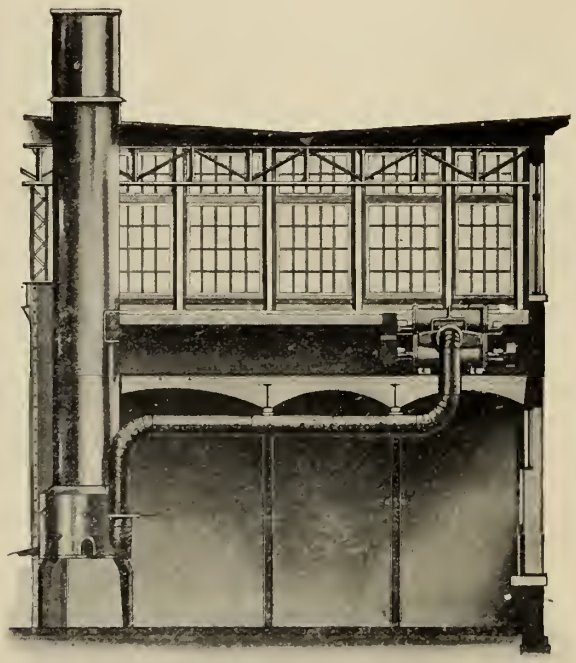
When the Canadian Pacific Railway was building its main line through Western Ontario, the graders cut through a rock formation carrying both copper and iron. This was a point north of Georgian Bay, now known on the map as Sudbury.

The per cent. of copper in the rock was small, running from two to three per cent., but it was sufficiently rich to warrant an attempt at development. The Canadian Copper Company was formed, and the Copper Cliff mines opened up. The ore was shipped, some to Wales, and some to the copper reducing works at New Jersey.

Combined with the copper, was another metal besides iron. No one seemed to know what it was. It was new to the experts, both at the mines, and at the reduction works. So the New Jersey smelter allowed it to run off with the slag. Not so with the Welshmen—they knew the metal and also knew its value. Like good business men they kept their secret and bought all of this particular copper ore they could get—the nickel was worth more than the copper—and it was clear profit. But the secret at last came out, and the Sudbury copper mines became the greatest nickel mines in the world.

The mines at Copper Cliff, a few miles from the present town of Sudbury, resembles the ordinary copper mines—the shafts have already reached a depth of 1,200 feet—and the nickel-copper bearing vein shows no sign of exhaustion. The Creighton mines, however, are like the mines of the Mesaba iron range—vast excavations where the steam shovel has laid bare acres upon acres of rich ore—there seems to be no limit to the amount. The ore runs about two per cent. copper, six per cent. nickel, 40 per cent. iron and the rest mostly sulphur. After reduction, a ton of ore will turn out about 120 pounds of nickel, which now bring 40 cents per pound.

The ore is partially reduced at the mines. It is crushed and screened, then spread out over vast beds of cord wood —acres in extent. Fire is applied, and the ore roasts for sixty days. This process drives out most of the sulphur leaving the metals in a form called matte. This matte is shipped to the refining works in Constable, N. J., where the nickel of commerce is made.



High Pressure Blower Connected to Foundry Cupola

USES OF THE BLOWER IN THE FOUNDRY.

NO device is more vital to the operation of the modern foundry than that by which air, under the requisite pressure, is supplied to the ig-

nited fuel within the cupola. Cupolas may vary in their proportions, and coal, coke and iron in their quality, but under no conditions can successful melting be accomplished without the employment of some device partaking of the nature of a blower. Although most important, this is by no means the sole purpose for which a blower is, or may be, employed in a foundry.

Under the broad term "blower" may be classed four types of machines, differing widely in their construction and operation.

First, the peripheral discharge fan wheel with enclosing case.

Second. The propellor or disc wheel, discharging its air in lines practically parallel to its axis.

Third. The so-called rotary blower with close fitting revolving propellors, and

Fourth. The blowing-engine, acting upon the principle of the plunger pump, and capable of producing pressures several pounds to the square inch.

Of these four types the second, or propellor type, is absolutely valueless for cupola work, because of its inability to produce the required air pressure, while the fourth, or blowing engine type, is too complicated and expensive for use in the ordinary foundry. For all purposes, except blowing cupolas, the fan blower is the only type which is adaptable.

According to the purpose for which they are designed, fan blowers may be classed either as volume blowers or pressure blowers, although one type naturally merges into the other. In either type the fan blower, proper, consists in its simplest form of a number of blades extending radically, or nearly so, from its axis and presenting practically flat surfaces to the air as they revolve. By the action of the wheel the air is drawn in axially at the centre and delivered from the tips of the blades in a tangential direction. It is therefore designated as a centrifugal fan, or, more properly, as a peripheral discharge fan.

If volume alone, regardless of pressure, is the requisite, the larger the fan the less the power required. There is a strong temptation, however, for a purchaser to buy a smaller fan and run it at a higher speed; for he sees only the first cost and does not realize the entailed expenditure for extra power. If possible, a fan should never be made so small that it is necessary to run it above the required pressure in order to deliver the necessary volume. To double the volume under such conditions requires eight times the power; three times the volume demands twenty-seven times the power.

For certain purposes, such as the blowing of cupola furnaces, a comparatively small volume of air is required, but under high pressure. For exhausting, blowing boiler fires, and the like, the volume required is greater and the pressure relatively less. The former wheel requires to be narrow at the circumference, thus providing for the escape of only a small amount of air. When a fan is employed for exhausting hot air or gases, the speed required to maintain a given pressure difference is evidently greater than that necessary when cold air is handled, the difference being due, and inversely proportional, to the absolute temperature.

First of all among the different types of fan blowers employed in the foundry is the pressure blower for blowing the cupola. The fan wheel is narrow, with tapering sides, reducing to the minimum width at the outer circumference where the air escapes from the wheel into the surrounding case. Numerous curved blades or floats serve, by their continuous action, to prevent the return of this air to the wheel centre, and thereby maintain the pressure due to their tip velocity.

There are many other uses of the fan blower in the foundry—uses in which it has no practical competitor. Employed as an exhaust fan, and properly designed for its work, it has found an extended application for removing the dust from tumbling barrels, from emery wheels, and, in fact, for exhausting dust, smoke or objectionable gases from any machine or apartment in which they are generated. For such work the fan is driven at comparatively low speed, and proper connection made to the space or spaces from which the objectionable matter is to be drawn. This passes through the fan and thence to any desired place of deposit and is discharged into the open atmosphere.

In the case of the pattern shop, which usually forms an adjunct of the foundry, a fan of this type in the form of a planing mill exhauster is usually of advantage for the removal of shavings and sawdust. The width of the wheel in such a fan is far greater both at inlet and outlet than that of a pressure blower wheel. A large volume of air at comparatively low pressure is thus passed through the fan with a minimum expenditure of power.

A similar typr of fan on a larger scale is used in connection with a steam-pipe heater for the heating and ventilation of the model foundry. By the concentration of all the pipe in a single heater across which large volumes of air are caused to pass, the amount of pipe is reduced to from one-third to one-fifth of that which would be required if it were strung around the foundry, as in the case of direct radiation. This concentration of the heating surface also serves to reduce to a minimum all possibility of freezing, renders the regulation of temperature as simple as is possible, and presents numerous other advantages. The heated air is distributed by means of the fan through a more or less extended system of underground ducts with vertical wall flues or of overhead galvanized-iron piping. The large quantity of air thus supplied secures adequate ventilation, causes all air leakage to be outward and serves to keep the foundry comfortable and clear of gas and steam during the heat, if cool or slightly tempered air be then supplied.

A similar form of apparatus, designed to deliver air at high temperature, may be employed for drying flask and pattern lumber, when the quantity is sufficient to warrant the arrangement.

Although the boiler plant in connection with an independent foundry is usually of somewhat limited size, nevertheless, the fact should not be overlooked that the fan blower is rapidly usurping the place of the chimney in the production of draft, or serving as its assistant in securing desired results. Applied to force the air into a closed ash pit creates a pressure which makes possible a high combustion rate, the burning of cheap fuel, and the attainment of the maximum capacity of the boilers. Employed as an exhauster, through which the gases are drawn, it, in addition, does away with the necessity of a high chimney. Under either form of application perfect control may be maintained over the draft pressure, and it may be automatically increased or decreased coincidently with a slight fall or rise in the steam pressure, which thus remains almost absolutely constant.

Either as a convenience or as a necessity the fan blower is ever in demand in the foundry, and its form of application are constantly increasing. It, therefore, stands to-day as a specific type of machine, whose general advantages and peculiar adaptability are becoming more and more familiar to every manufacturer and engineer.

A coal firm had a very stupid fellow to look after the yard, and so decided to discharge him because his stupidity entailed much annoyance and loss of time to the firm.

He was called into the office and told this, one of the partners remarking that he had actually learned nothing since entering upon his duties, upon which he retorted'

"One thing I have learned that I didn't know before."

"What is that?" asked the partner.

"That seventeen hundredweight makes a ton," was the reply.

On this ground he was not discharged.

Practical Questions and Answers

Increasing the Compression.

Ques.—In view of the fact that more power can be obtained from the same sized gas or gasoline engine by increasing the compression, what is the chief reason that the compression is not higher than common gas and gasoline engine practice allows?

Ans.—It is true that increasing the compression in a gas engine gives increased economy of operation, and not only can more power be obtained from a certain size of cylinder, but this power is secured at a smaller gas consumption per unit of power. The chief reason that the compression is not higher than practice at present dictates is that the higher the compression, the greater is the inflammability of the mixture, and thus the higher the compression is run the greater is the danger of pre-ignition, that is the premature firing of the charge.

Ordinarily gas engines to run on coal gas, are not designed for a higher compression than 110 pounds, compressions higher than that being liable to heat the charge to such an extent as to cause pre-ignition. Very recently, however, an English gas engine firm placed on the market an engine designed for a compression of 200 pounds, pre-ignition being prevented by drawing into the cylinder a small quantity of water during the suction stroke. This water absorbs heat from the walls of the cylinder during the suction stroke, and apparently is turned into steam. During the compression stroke the steam becomes superheated thus absorbing more heat. The result of the presence of the water is that the final temperature of compression is considerably decreased thus lessening the danger of pre-ignition.

An engine of the type tested by Professor F. W. Burstall, Birmingham University, and the test showed a very creditable efficiency.

The engine was of the electric lighting type with heavy flywheel; the cylinder was 14 inches in diameter, and the stroke of the engine was 21 inches; the engine was loaded by means of an all-round rope brake; the duration of the test was 6 hours and 45 minutes; coal gas was used with an average calorfic value of 578 B.T.U., per cubic foot at 60 degrees Fahr. and atmospheric pressure; the ratio of expansion in the cylinder was 8.7; the maximum pressure in the cylinder, as shown by indicator cards, was 528 pounds gauge; the average pressure during the suction stroke was 1.9 pounds below atmospheric. During the test the engine ran quite smoothly and without any premature ignitions or back explosions. From the observations during the test it would appear that the water behaves in the way before described, and that heat passes from the walls of the cylinder into the charge until a pressure of about 160 pounds is reached, when the heat seems to equilize; down the expansion curve the change appears to give up heat to the walls. The ratio of air to gas, as found from the exhaust gases, is 10.2. The heat was found to be spent in this way, re 37.4 per cent. indicated work, 29 per cent. rejected to the jacket water and 33.6 per cent.. This 37.4 per cent. is a very high indicated efficiency.

A few results of the test are as follows: average brake horse power, 49.7; average indicated horse power, 60.5; mechanical efficiency, 82.2 (which is not low when the type of engine is considered); gas per indicated horse power, 11.77 cubic feet at 60 deg. Fahr. and atmospheric pressure; gas per brake horse power, 14.43 cubic feet; thermal efficiency on the indicated power, 37.4 per cent.; thermal efficiency on brake horse power, 30.8 per cent.; water discharged from jacket per minute, 25.6 pounds; average rise in temperature of jacket water 77.5 deg. Fahr.; mean temperature of the exhaust, 381 deg. C; water passed into cylinder per minute 0.131 pounds; average percentage of carbon-dioxide in exhaust gas, 5.7 per cent.; average percentage oxygen in exhaust gases, 9.6 per cent.

Operation of the Injector.

Ques.—Will you please give me a practical explanation of the operation of the injector, or at least one with as little mathematical consideration as possible? J. K. A.

Ans.—It is rather difficult to give a comprehensive explanation of the action of the injector without entering into mathematical deductions. The author of the "Locomotive Up-to-Date" has attempted to give a practical explanation with some degree of success. He says:

The simplest method of considering the action of the injector is from a purely mechanical point of view, as an apparatus in which the force of a jet of steam is transferred to a more slowly moving body of water, resulting in a final velocity sufficient to overcome the pressure of the boiler. Consider, as a concrete example a boiler containing steam at 120 pounds pressure. According to the laws governing the flow of steam through properly built channels, the steam discharging through the minimum diameter of the steam nozzle into the atmosphere, or steam of lower pressure, will reach a velocity of about 1,400 feet per second, but when it discharges into a combining tube in which there is perhaps a 20-inch vacuum (which is not unusual), the velocity will be about 1,500 feet per second. In supplying water to the injector at the rate of 13 pounds to 1 pound steam, which is a fair performance at the pressure stated, the water will receive the impulse of the moving steam, condensing the later, and the two move along together through the delivery tube with a final velocity which is very much less than the original velocity of the steam jet. This final velocity, under the conditions named, is about 170 feet per second. In order that the injector should work properly, this velocity must be greater than that with which the water in the boiler would issue from the delivery tube under a pressure of 120 pounds per square inch, which velocity is about 133 feet per second. It will be seen, therefore, that there is a considerable margin of available energy in favor of the moving mixture of steam and water as against the "stationary" resistance, under the same pressure, of the water in the boiler.

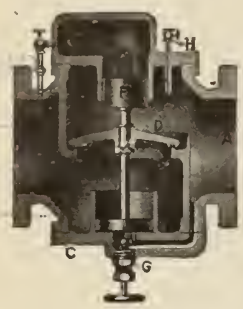
An injector must have the proportions of steam, water and delivery areas so designed that the velocity of the moving mixture of steam and water will be greater than the velocity at which a jet of water would flow from the boiler under the same pressure. If the weight of water supplied is too great, the steam will not have the power to give the water the required surplus of velocity; if there is an insufficient supply, the volume of the steam will not be sufficiently reduced by condensation to pass through the nozzles, and in neither case will the injector perform its functions properly.

Power and Transmission

Steam Gas Electricity Compressed Air Water

COMBINATION RELIEF AND BACK PRESSURE VALVE.

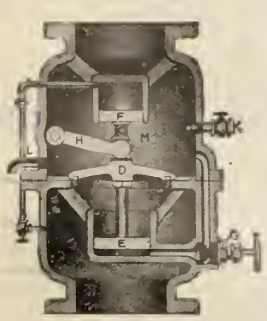
FOR plants running condensing in the summer months and utilizing their exhaust steam for heating in winter, the combination relief and back-pressure valve is designed. The illustrations show both the vertical and horizontal



Eclipse Horizontal Combination Valve.

type, as manufactured by the John Davis Company, Chicago.

When used as a back-pressure valve the controlling valve G is opened, which equalizes the pressures upon the top of the main valve D and beneath the piston E. The valve is then held to its seat by its own weight and by the weights upon the lever attached to the rod carrying the arm H. The piston F acts as a dash-pot to prevent violent action. When a back pressure exceeding five pounds per square inch is desired, a by-pass P is provided, allowing steam from the high-pressure side to act on the piston F, assisting in holding the



Eclipse Vertical Combination Valve.

valve to its seat, and avoiding the necessity of excessive weights on the lever. Should the valve show any tendency to chatter, the controlling valve G may be adjusted so as to dampen the action, and is so sensitive as to control the pressure within a fraction of a pound.

When the system is run condensing, the controlling valve G is closed, making the piston E act like that of a vacuum dash-pot. The weights are removed from the lever, and on the loss of the vacum the valve is raised from its seat by the steam accumulating below it, allowing the engine to exhaust into the atmosphere. The combined action of the two pistons prevents the valve from slamming with the pulsations of the exhaust. The valve is sealed against air leakage by admitting water through the valve K, in an amount sufficient to maintain a slight drop at L. The working parts, including the valve seat are of bronze and the valve is babbitted.

COMPRESSED AIR FORGES.

THE use of compressed air for producing the blast in portable riveting forges has recently been developed by the Canadian Buffalo Forge Co., Montreal. One such application is shown in Fig. 1. In this design the air is admitted by a needle valve through two brass nozzles into a cast iron mixer nozzle and thence direct into the tuyere. The action resembles that of a steam injector, free air being drawn in to augment the volume. By the use of this needle valve, the volume of air furnished is varied without affecting the pressure, and by the compounding of the injector action, the volume of compressed air required is reduced one-half. Another application, in which the compressed air acts directly upon the blast fan of the forge, is shown in Fig. 2.

Extensive experiments show great economy in using the jet of air direct into the tuyere, as described above. For example, it is stated that it takes one-ninth the amount of air to operate a forge in this manner, that it does to operate the fan forge with compressed air, as in Fig. 2, and it takes one-fortieth as much as it does to operate the free air forge with an ordinary blower. The pressure required is not high, in fact very low pressures have been used advantageously.

The wide application of these forges for use on bridge and building construction, in large railroad and repair shops, and in fact wherever compressed air is available, will readily be appreciated, and the saving of time and labor in their usuage, as well as the ease with which they may be connected by a small hose to the compressed air, should appeal to users everywhere. Although the Buffalo Forge Company makes both forges mentioned above, it recommends the compound compressed air operated on

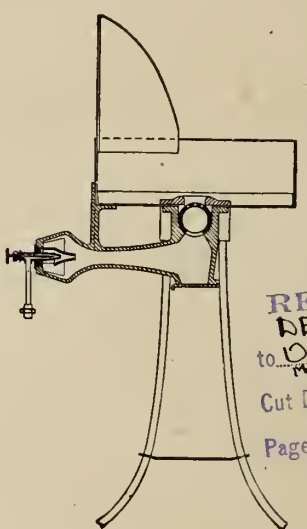


Fig. 1 — Buffalo Compressed-Air Injector Type Forge.

the injector principle, Fig. 1, because of the greater simplicity, economy and more rapid heating obtained.

THE ABUSE OF VALVES.

A LARGE number of valves are returned to the manufacturers in the course of time by purchasers, who claim that the valves are defective in workmanship and not tight, says the Valve World. The

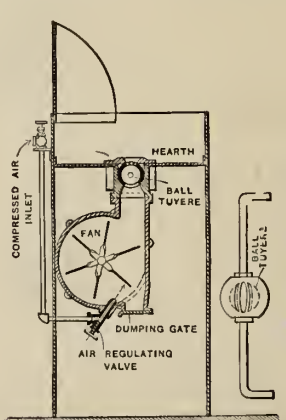


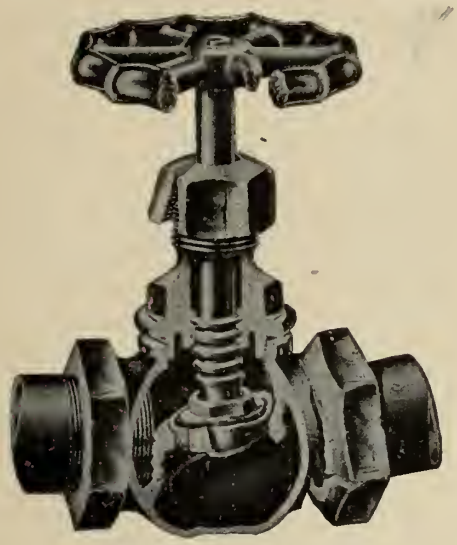
Fig. 2—Buffalo Compressed Air Driven Fan Forge.

manufacturer is not only requested to credit the valves returned, but must bear the expense of taking valves out of lines and putting them back, the carrier's ex-

penses both ways and also the criticism and injury to his reputation.

When the goods claimed defective are received and have been submitted to the most careful examination and tests, it has been found that in ninety-five cases out of a hundred the valves leak on account of the abuse and carelessness of the parties who installed them.

It is a very easy matter for a practical valve maker or a good steamfitter to determine when and just how a valve has been abused, and if customers would take a little pains to examine leaky



Abuses of Valves Illustrated.

valves before returning them, they would find that the valves had been abused by their own men.

Anyone who has done considerable steamfitting work should be able to determine for himself whether a valve had been abused, or would have in his employ someone capable of doing this, and be able to remedy the trouble without annoying the manufacturer with it.

The following are a number of reasons why valves leak after being placed in a pipe line:

1. We are confident that ninety per cent. of all the trouble with leaky valves arises from the improper use of cement, and from the failure to remove the particles of cement, scale, chips, dirt, etc., that naturally get into the pipe while it is lying around a building and then lodge on the valve seat after steam is turned on. When applying cement, it should be put on the male part only, for if placed on the female part, it goes through the pipe and gets on the valve seat. In any case much more cement is used than is really necessary. If steamfitters would take pains to apply the cement as above directed, and also make sure the pipe is clean by standing it on end and striking it a few times with a hammer, before putting it into place, in order to loosen any scale or dirt that may be inside, an immense amount of trouble would be avoided. As a further precaution, it is well, when a job is started up, to open all the valves throughout the building and blow the steam through them thoroughly. After doing this properly there will be very little material in the pipes to cause trouble.

2. It occasionally happens that threads on pipe are cut longer or smaller than standard, in which case, if the pipe is screwed into the valve, it very likely will run up against the partition and injure it.

3. In the lighter class of valves, one of the common abuses is the application of a pipe wrench on the opposite end of the valve from the end which is being screwed on the pipe. This should never be done, as it invariably springs the valve and of course causes it to leak.

4. If a light valve is put into a vise for the purpose of removing the centrepiece, the valve should certainly be clamped lengthwise. In all cases when removing centrepiece care should be taken to have the disc some distance from the seat, as otherwise the disc will be forced onto the seat and some part of the valve become strained. Never use an old strained monkeywrench on a centrepiece, as such wrench is quite likely to squeeze the corners of centrepiece out of shape. If found impossible to remove the bonnet or centrepiece by ordinary methods, heat the body of the valve just outside the thread with a blowtorch, or any other available means that can be applied to the body and not to the centrepiece. Then tap lightly all around the thread with a soft hammer. This method never fails, as the heat expands the body and breaks the joint made by the litharge or cement.

5. Often when a stuffing-box leaks, a steamfitter will endeavor to stop the leak by straining the stuffing-box with a large wrench, when the difficulty is due to the packing having become worn out and needing to be renewed.

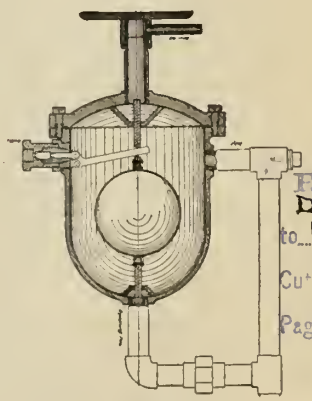
6. It sometimes happens that when a valve is to be used on a header, the steamfitter will start out with a long piece of pipe that is unsupported, and, through carelessness, will allow the strain of the pipe to come on the valve, thereby springing it.

7. Serious trouble is also likely to occur in a pipe line where light valves are used through the fitter not making proper allowance for expansion and contraction and allowing the strain to be thrown on the valves. The pipe and fittings are much more rigid and stiff than the lighter brass valves, and in consequence the expansion strains will relieve themselves at the weakest point, unless otherwise provided for. A very good example of this is illustrated in most high buildings heated by steam, where it is difficult to take care of the expansion. The steamfitter will branch out of his riser with a feed pipe to radiator. The radiator will have high legs and the air valve end usually stands close to the riser. He runs this branch (from three to six feet in length) underneath the radiator to the front end, and usually connects same to the radiator valve by a short nipple. This cross piece or branch under the radiator is supposed to take up the expansion and contraction of the riser, which may expand from one-half inch to one and one half inches. He does not appreciate the fact that the ordinary light angle radiator valve is the most flexible of all the connections and will spring or distort itself before anything else in the branch.

8. Very often, when a valve leaks, some one will stupidly undertake to tighten it by using some kind of a lever on the wheel. This should never be done as it will in all probability injure the valve. As the trouble undoubtedly is due to the presence of dirt in the valve it is very much better in such cases to take the valve apart and clean the seat.

THE BURROWS STEEL TRAP.

THE simplest device for trapping water from a steam system is a float with the valve directly attached to it. The movement of the float is, however, a great deal more than is required for the valve, and this greater movement can be utilized through a



Burrows Steam Trap.

proper leverage to overcome a greater force through a shorter distance.

This is what has been done in the trap under consideration. The float, instead of lifting the valve directly, lifts a horizontally disposed lever to which the valve is attached, and is thus able to open a larger valve against a given pressure or to handle a smaller valve with greater positiveness. An equalizing pipe prevents the trap from becoming air-bound. The Burrows Manufacturing Company, 73 Warren Street, New York, is the manufacturer.

ABOUT CATALOGUES

By mentioning Canadian Machinery to show that you are in the trade, a copy of any of these catalogues will be sent by the firm whose address is given.

TYPE "S" MOTORS. Circular No. 1068, illustrating and describing type "S" D. C. dynamos and motors. It is a 15 page bulletin, well illustrated.

AUTOMATIC CONTROLLERS. Circular No. 1136 of the Canadian Westinghouse Co., Hamilton, illustrating their automatic controllers for direct-current motors.

DIRECT-CURRENT MOTORS. Circular No. 1138, of the Canadian Westinghouse Co., Limited, Hamilton, illustrating and describing two types of their direct-current motors.

S. & S. ENGINEERING CO. A pamphlet illustrating the S. & S. variable speed countershaft. Canadian branch of the S. & S. Engineering Co., is at 255 Jackson St. West, Hamilton, Ont.

METAL WORKING MACHINERY. A bulletin catalogue issued by the Fitchburg Machine Works, Fitchburg, Mass., describing on separate sheets the wide variety of lathes as manufactured by this company.

FINISHING FLYWHEELS. Single leaf bulletin, issued by the Gisholt Machine Co., Madison, Wis., illustrating and describing the methods of automobile engine flywheels on Gisholt lathes.

ATLANTIC OIL COMPANY. A prospectus of this company is issued from Toronto, Ont., giving information regarding the company and the properties which it proposes to work in British Columbia.

RHEOSTATS. Circular No. 1139, of The Westinghouse Electric & Mfg. Co., Pittsburg, Pa., descriptive of the construction and operation of their standard starting and field rheostats. It is a 17 page circular, well illustrated.

STERLING HACK SAWS. A circular and booklet describing the Sterling power hack saw, manufactured by the Diamond Saw & Stamping Works, Buffalo, N.Y. Some pointed paragraphs are given revalent to the Sterling saws.

STEEL SHEET PILING. A catalogue and circulars dealing with the interlocking steel sheet piling, made by the United States Steel Piling Co., Chicago, Ill. To engineers and contractors this catalogue should prove of very decided interest.

BRICK MACHINE. Catalogue describing the process of manufacture of sand-cement pressed brick, advocated by The McIntosh Brick Machine Co., Goderich, and illustrating and describing the machine built by them for the manufacture of sand-cement brick.

ENGINEERING WORK. Section A of the engineering work catalogue of The Wellman-Leaver Morgan Co., Cleveland, O., containing very handsome illustrations and short descriptions of engineering works which have been carried out by this firm. It is 12 x 9 ins.

WATER COOLING. The De La Vergne Machine Co., foot of East 138th St., New York City, has just issued a folder describing the Klein water cooling tower built by them. These towers will cool the water to from 5 to 15 degrees below the temperature of the atmosphere.

BUILDING BLOCKS. Catalogue in which is described the Huennekes system of making sand-lime brick and building blocks, as owned by the Standard Brick Machinery Co., engineers and contractors for the erection of sand-lime brick plants, 114-118 Liberty St., New York.

AUTOMATIC VISES. A pretty little art calendar describing vises manufactured by the Pittsburg Automatic Vise & Tool Co., Pittsburg, Pa. Illustrations are given of the different styles and patterns of this vise. The smaller illustrations in this booklet showing its many adaptations.

CHAMPION. An art booklet devoted to the Champion automobile repair kit manufactured by Patterson, Gottfried & Hunter, 146 Centre St., New York. Each page contains a descriptive verse, the whole dealing with the automobilists fight when not provided with one of these repair kits.

ENGINEERS' CATALOGUE. The New York Belting & Packing Co., Limited, who are represented in Canada by the Economical Mfg. & Supply Co., of Toronto, issued this catalogue. It is devoted to the many styles of packing and belting manufactured. 48 pages, 3½ by 6.

MOFFATT FUEL SAVER. A 19 page catalogue showing the application of the Moffatt fuel saver to furnaces, and giving information concerning same. A number of highly complimentary testimonial letters are shown, together with a list of the users of the Moffatt fuel saver in Ottawa and vicinity.

COLD HARD CASH. This is the striking heading of a folder issued by the Canadian Casualty & Boiler Insurance Co., 22-24 Adelaide St. East, Toronto. It gives a lengthy list of names that will testify to the promptness of claims being paid by this company. In each case the amount of claim paid is given.

TAPS AND DIES. The general 1906 catalogue of Butterfield & Co., Rock Island, Que., manufacturers of screw plates, taps and dies, and reamers, etc. The catalogue is a very complete one, being well illustrated and containing specifications and price list of the tools. It contains 84 pages, 6 x 9 inches.

TECHNICAL THERMOMETRY. General catalogue of the Cambridge Scientific Instrument Co., Limited, Cambridge, Eng., being a descriptive catalogue and price list of all kinds of heat measuring instruments made by this firm. The catalogue contains 62 pages, 8½ x 11 inches, and is very complete.

RIVET MACHINERY. Standard sized catalogue dealing with "cold process" automatic bolt, nut and rivet machinery built by the Waterbury Farrel Foundry and Machine Co., Waterbury, Conn. This catalogue is profusely illustrated, and contains short descriptions and specifications of each machine illustrated.

STEAM SPECIALITIES. This catalogue is from the Canadian office of which William N. Courtnay is manager, at 113 Temple Bldg., Montreal. Greenway separators are described and illustrated to some length. The various types in use being shown further illustrated, in many cases showing the diagrams necessary for these separators.

THE RUSSELL. A well illustrated catalogue devoted to the Russell motor car, manufactured by the Canada Cycle & Motor Co., Limited, Toronto Junction, Can. The mechanism of the motor comes in for considerable attention, the various parts being well illustrated and described. Different types and models are shown exhibiting the variety of cars turned out by this company.

SAND LIME BRICK. Catalogue issued by the American Sand-Lime Brick Co., Chicago, illustrating and describing the American system for making sand-lime brick. The catalogue, besides containing an interesting description of the process of manufacture of the brick, has full page illustrations of the interior and exterior of many plants scattered throughout the States where these brick are manufactured.

FIND HORSE POWER. Chart issued by Sadler & Haworth, of Montreal, to immediately determine the horse power of a certain width belt running at a given number of revolutions. It also enables a person to find the feed required to transmit a certain horse power with a given width belt. The operation in doing this is confined to the revolutions of a circular disc. It is a handy little article for anyone requiring to find horse power in belt transmission. A card dropped to this firm will bring one of these to any one interested.

MODERN MACHINE TOOLS. Superior to any attempt previously made in Canada in its line is the beautiful catalogue just issued by the John Bertram & Sons Co., Limited, Dundas, containing 255 pages, 9½ by 12½. The illustrations are all a work of art, and reflect credit not only on the engraver but on the photographer and the compiler of the catalogue. The frontispiece contains a bird's eye view of the Bertram Works as they will appear when plans already under way will have been completed. In the introduction mention is made of the story of the development of this firm since 1861, that from a humble beginning it has become the largest working machine tool plant in Canada. The catalogue is divided into sections, showing the separate classes of machinery. No other concern in America make a wider range of machine tools than John Bertram & Sons. The range is too wide and varied to permit of even bare mention here. A specialty of this firm is heavy tools for locomotive and car shops, and for these particularly the firm has a world wide reputation. As a catalogue of machine tools it is very extensive and full of information. As a work of art from the view point of the bookbinder it is superb.

Machinery Development

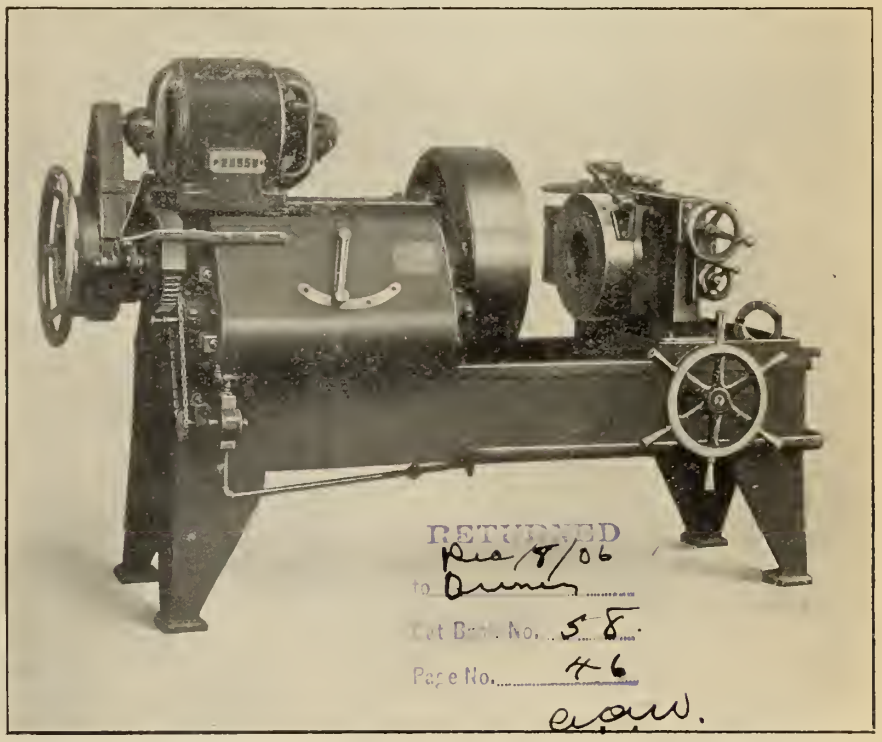
Metal Working ***Special Apparatus*** ***Wood Working***

4-IN. MOTOR DRIVEN MACHINE.

ILLUSTRATED herewith is a four-inch motor driven pipe cutting and threading machine, manufactured by the Stoever Foundry and Manufacturing Co., Myerston, Pa. While the motor driven machine is shown, all speeds being obtained in the gearing, there is but little difference between the belt and motor driven types. To equip the machine for motor drive, the belt pulley is removed and a sprocket wheel for the chain put in its place. The motor table is placed above the main bearings as shown, and by the addition of the motor and the chain, the equipment is complete.

It will be readily seen, that this method of motor drive has great advantages. In the first place, it renders an easy change from a belt drive to a motor drive at any time, and the motor driven machine has all the advantages of speed which are obtained in the belt driven machine, and without the extra expense and necessary waste of current which accompany the use of resistance boxes and controllers. With this design of drive, a constant speed motor is employed, which is the least in first cost and the highest in efficiency in operation. A variable speed motor could of course be used if anyone wished to do so, and an additional range of speeds would be secured. The machine is of exceedingly substantial construction throughout—a departure from the older practice has been made in making the headstock in one casting, following the usual lathe construction. The gearing is all on the outside of the machine, and readily accessible for any purpose. An innovation in pipe threading machinery is the use of an internal gear drive, which is exceedingly powerful, very compact, and, of course, very safe, as the teeth are carefully protected.

The machine has twelve (12) speeds, the shifting gears in the gear box giving four (4) speeds, and the clutch on the machine three (3) for each one in the box. These speeds can all be very quickly obtained, and the change is more easily made than when shifting a belt on a cone pulley, and making the additional gear change required in older machines. The gripping chuck of the machine is of the universal type. All of the interior parts are made of steel; the gripping jaws are made of tool steel carefully hardened—there are three (3) jaws. The rear chuck is also of the universal type with three (3) jaws, its function being to simply centre the pipe, holding it in line with the die head. The large hand wheel on the outer shell of this chuck enables it to be very easily operated. The oil for lubricating the dies is furnished by a rotary geared pump of the best construction, driven by a steel chain from a constant speed shaft on the machine. There can be no slip, and there must be a positive supply of oil delivered at all times. The actual amount used on the dies and cutting-off tool, is regulated by valves at the proper points, and the relief valve takes care of any excess.

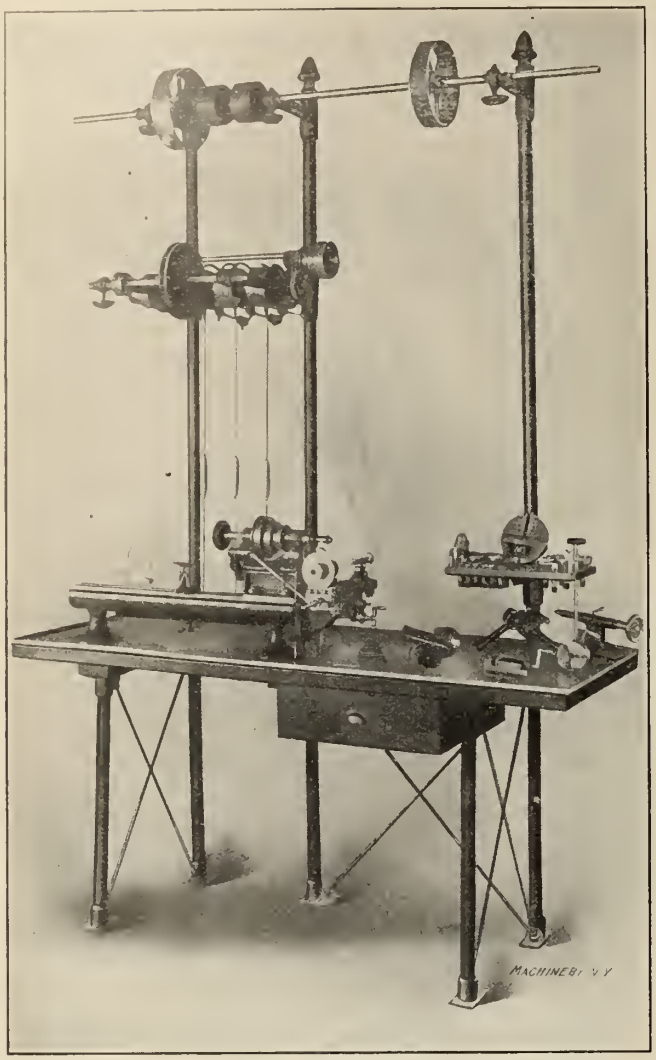


A 4-in. Motor Driven Pipe Cutting and Threading Machine.

The die head has been greatly improved by the substitution of interchangeable hardened steel cams, for those of cast iron construction commonly used in other machines. This not only ensures a much greater life and accuracy for the head, but if, for any reason, it should become necessary to replace a cam, it can be very easily and cheaply done. In addition to these hardened cams, hardened steel plates are placed in the bottoms of the die slots. These ensure a permanent bearing for the back edge of the chasers, and therefore keep the lead correct, which is a very important point. The sliding head has been adopted for the regular design, as it offers many advantages over the older type of stationary head. One advantage lies in convenience often secured by placing pipe in the machine through the die head, in which case the head can be pushed out of the way and the pipe pushed through the opening in the stand without injuring the dies. The gr?atest benefit, however, lies in the fact that the head is movable—floating to a certain degree. As there is a certain amount of eccentricity to be found in all pipe, a great strain is brought on the dies when used in a rigid head, but by making the head movable it will adjust itself to the eccentricity of the pipe as it revolves. This not only relieves the head of unnecessary strain, but ensures a more equal depth of thread round the circumference of the pipe. The slides for cutting the pipe while cutting off, and which are placed on the back of the stand, are unusually heavy,

and faced with hardened steel plates for guiding the pipe. The cutting-off tool is held on one of these slides, and the reaming tool is also held on the same slide. The bed is made of special construction to ensure unusual stiffness between the headstock and the opposite end. The oil reservior is in the bed, and a smaller supply than usual is used for necessary lubrication.

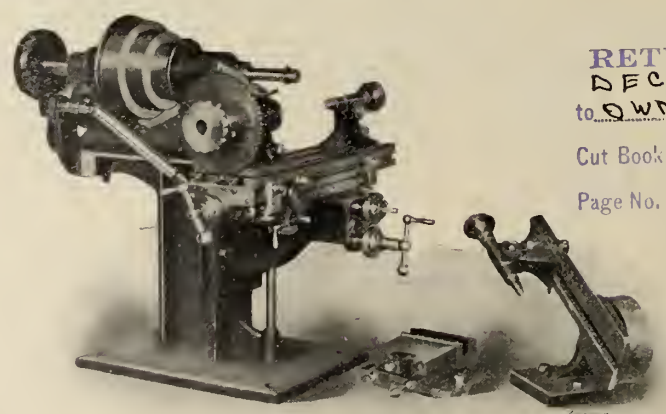
It has been the endeavor to design a machine which will be simple in the arrangement of its parts, thoroughly accessible, and easily and cheaply repaired in case of accident. The machine weighs complete with equipment about 3,200 lbs.



Milling Attachment for Bench Lathe.

BENCH MILLER AND MILLING ATTACHMENT.

ONE of the illustrations represents a new bench milling machine which consists in part of some of the attachments for the Cataract bench lathe. The table of this miller drops 7 inches from the centre of the main spindle, is 12 inches long and has power cross feed when driven by the regular screw cutting attachment used for the bench lathe. All feed screws are supplied with 1½ inch index reading in thousandths, constructed the same as for the slide rest of the lathe. The machine is obviously very useful in getting out die and jig work. The main head is the same as is used for the No. 3 Cataract lathe, the spindle having 1-2 inch capacity clear through. The dividing head measures 2 1-2 inches to centres and has a 4 inch index plate. It admits the No. 3 chuck, thus interchanging with the head. The same dividing head is used in connection with the adapter shown to the right with a footstock in place, this enabling one to get any angle of head to 45 degrees. It is especially suitable for small taper tap work as the footstock can be kept in proper alignment. A vise is made for this miller, adapting it to a variety of small work. A milling attachment for the same bench lathe is shown in Fig. 2. This is identical with the bench miller with the exception of the main frame. The proper height for the frame above the bench is obtained by raising the head 3 inches above the top of the bed. As will be noticed, the apparatus is shown as used with the combined bench and countershaft arrangement as illustrated. The countershaft with this arrangement is carried by the gas pipe uprights and has two cones whose shafts are connected by a pair of gear. The cone for driving the milling attachment being 3 inches higher than the one for the lathe head, so that one can take the head from the lathe and place it upon the milling machine and still retain the same length of belt. As the same countershaft, lathe head, and screw attachment are used as with the lathe, the attachment for milling can be applied quickly. The shifting of the countershaft belts is accomplished by the rods at the rear, but foot treadles can be used where desired. The countershaft brackets carry also a splined shaft for a high speed grinder pulley. Where required, the countershaft can be made to go on the wall in the usual fashion instead of on the 1 1-4 inch gas pipes.



Cataract Bench Milling Machine.

The manufacturers are Hardinge Bros., Chicago, Ill.

CHAMPION 14-IN. ENGINE LATHE

ADDITIONAL weight and rigidity, due to the extensive use of high speed steel tools, is the feature that characterizes the new standard 14 inch engine lathe, built by the Champion Tool Works Co., Cincinnati, Ohio.

The automatic stop for the longitudinal feeding mechanism, is an interesting

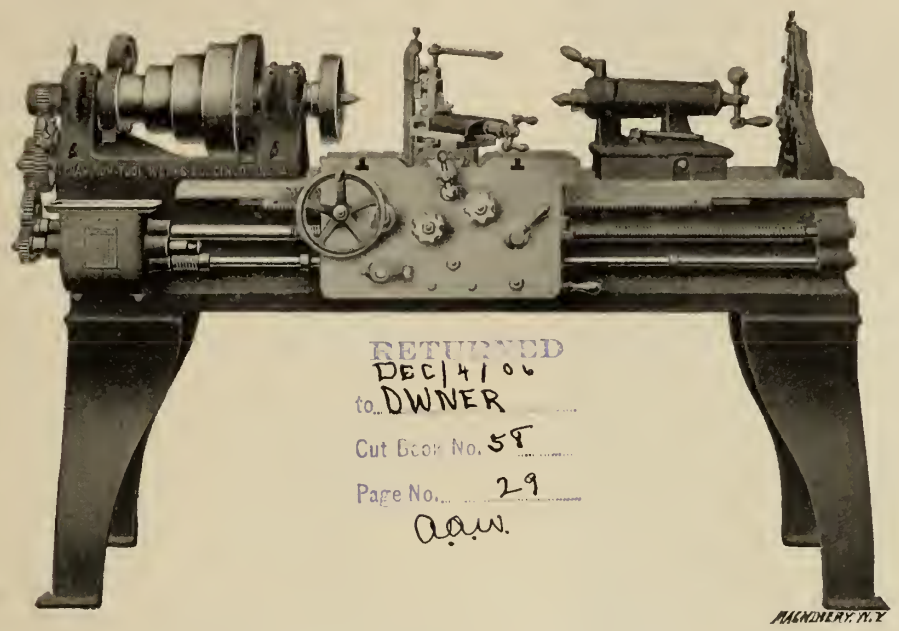


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Fig. 1—The New Standard 14-in. Engine Lathe.

feature. It may be set to and in any position of the carriage. The feed rod carries two adjustable collars, one on each side of the carriage, which, when encountered by a pin, which is part of the carriage, cause the lateral displacement of the rod. Such a movement in either direction disengages a clutch in the driving gear, on the feed rod in the gear box near the head end of the lathe, and the feed ceases. Normally the feed rod is held with the clutch engaged by two spiral springs, and on the feed rod. In this central position a key extending through the rod has its ends engaged by diametrically opposite notches on the inner circumference of a ring, which is integral with the gear. There are three sets of these notches, so that the clutch may be engaged at six different points in a revolution. The gear is otherwise loose on the feed rod. The clutch ring is held intact with the gear by the cap and the screws. The loose parts, gear and cap, are held against lateral movement by fixed parts of the containing case.

In the box is a nest of three gears, giving three different speeds to the feed screw. One or another of these gears is made active by a plunger and dive key, not shown on the detail. The plunger handle, however, may be seen on the exterior view given in Fig. 1.

The head spindle of the lathe is made from hammered crucible steel, and has a 1 9-16-inch hole bored from the solid stock. It is accurately ground and mounted in phosphor bronze boxes. The head and tailstocks are of large proportions, the latter being of the now common form in which clearance is allowed, so that a compound rest can be set at an angle, and it has a graduated base so that it may be set over for taper turning. The spindle centers are adapted for a No. 3 Morse taper, and the head center is bushed. The feeds can be reversed from both the apron and the head, and the arrangement is such that the rod and screw feeds can not engage at the same time, eliminating the danger of breaking apron parts. Cross and longitudinal feeds are provided, and all of the feeds are gear-driven, as has been indicated, with three changes of feed and thread, and an unlimited range of feeds and threads is possible by using additional change gears on the outside, between the spindle and the gear box.

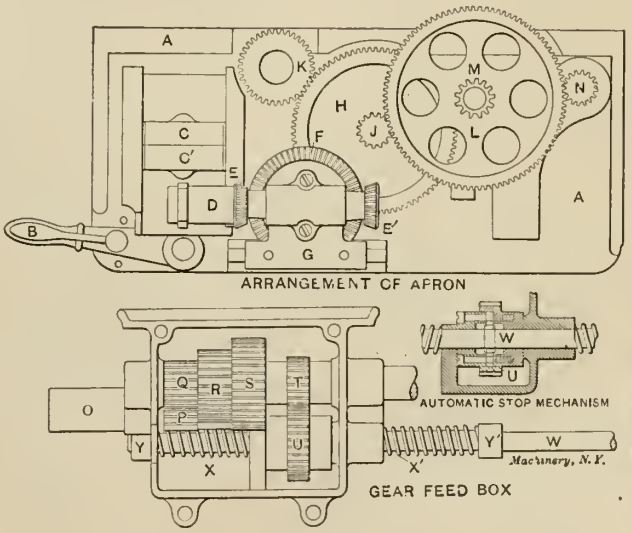

FIG. 2.

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A DECK CAULKING TOOL.

USUALLY the method of caulking the wooden deck of a ship is by hand. It is expensive as well as laborious, and in recent years has given way, to a considerable extent, to more expeditious methods, which involve the use of machinery. A neat tool for this purpose has recently been placed on the market. It is known as the Thor pneumatic deck caulking tool, and is constructed by the Independent Pneumatic Tool Company of Chicago and New York.

The accompanying illustration needs little explanation. The apparatus consists essentially of two parts, the feeder and the hammer. The latter is a standard pattern pneumatic hammer which is made by this firm. The feeder is made of cast steel, and is arranged to be fitted to the rest of the apparatus by means of a steel pin, which passes through a double eye-piece, through which the power of the hammer is transmitted. To minimise injury to the bearings owing to the action of the blows, a rubber cushion is placed in each eye-piece and also in each eye of the holder. These can be seen in the drawing. The pin acts as a spindle for the caulking discs, of which there are three kinds. The seam opener is used to open the seam to the required width to receive the oakum. Then the caulking tool is employed to insert the first caulking thread. Finally, two threads of oakum are caulked down on the top of the first thread by means of a third tool, called the maker. The oakum is laid down on the seam in long lengths, and one end threaded through the nose of the feeder, as shown in the illustration. As the feeder is

moved along, the oakum is automatically picked up. The machine is capable, so it is claimed, of doing much more work than it is possible to do by hand with ordinary tools—in fact, it is said that two apprentice carpenters can caulk 90 feet a day with two tools. Further, the firm states that for drumming decks one apprentice can do 900 feet in one day.

Caulking Deck Pneumatically

THE FORGING QUALITIES OF ALUMINUM BRONZE.

FOR both hot and cold working, no copper alloy can approach aluminum-bronze. In this respect it even surpasses copper itself as it is not so apt to crack during the operation. The yellow metals composed of copper and zinc are quite soft while red hot, but at a black head are brittle and crumble to pieces when attempts are made to work them at such a temperature. This fact frequently renders the hot working of the copper and zinc alloys a troublesome process. Aluminum-bronze, however, is not subject to this "black-shortness" and, therefore, it may be worked hot with as much facility as good Norway iron. Those who have had a limited experience with aluminum-bronze may not agree with this statement, but it is, nevertheless, true and those who have had trouble in rolling or forging aluminum-bronze on account of the cracking during the operation will sooner or later discover that the cracking is not caused by the nature of the aluminum-bronze itself but from having been poured at too high a temperature or from impurities in the metal.

The strength, homogeneity, non-corrosive properties, and forging qualities render aluminum-bronze an alloy which has never been equalled and for many uses it is unquestionably the best material. It does not seem to be subject to the phenomenon of crystallization so prevalent in the brasses and as far as non-corrosive properties are concerned it is the equal of any of the bronzes.

In 1894 the War Department, through the United States Board of Engineers, decided to adopt 9 per cent. aluminum-bronze for the foundation bolts of the new mortar batteries then about to be erected along the coast

The bolts that were used by our Government for the purpose of anchoring the gun carriages at the various batteries along the coast, were 2 in. in diameter and 6 feet long. The aluminum-bronze was made of Lake copper and pure aluminum in the following proportions: Copper, 91 lbs.; aluminum, 9 lbs. No zinc, tin, or other metal was added and a flux of common salt was used on the copper while it was melting. The aluminum-bronze was cast in a 4 x 4 square billet and 40 inches long. The casting was made in an iron mold and poured from the bottom so that the billet would be free from dross. The billets were rolled hot in one heat to the required diameter of 2 inches. After the rods were rolled, a head was upset on them in the regular manner practiced in heading a wrought iron bolt. In the illustration is shown the perfect head which it was possible to make on these bolts. A thread was then cut on the other end of the rod and the bolt was ready for use.

These bolts had a tensil strength of over 60,000 lbs. per sq. in. as the following test will indicate:

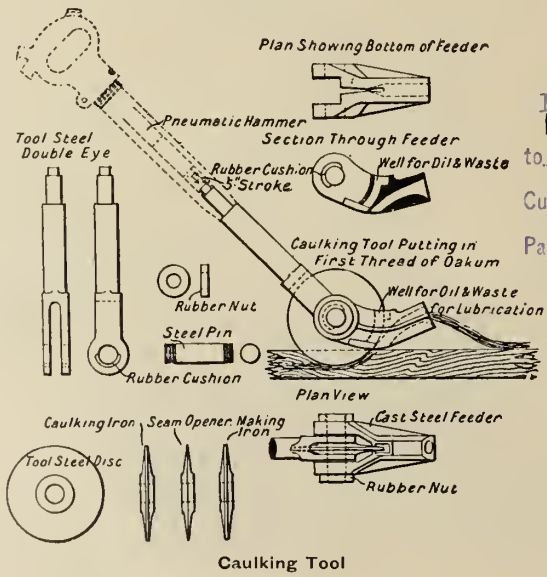
Average test on ten aluminum-bronze bolts:

Diameter—2 in.

Tensile strength per sq. in.—60,180 lbs.

Elongation, 8 in.—21 per cent.

Reduction in area—20 per cent.



Caulking Tool

Neither let mistakes or wrong directions discourage thee There is a precious instruction to be got by finding we were wrong It is at bottom the condition on which all men have to cultivate themsel es.

—Carlyle.

Alundum : The Latest Product of the Electric Furnace

NO more remarkable advance in mechanical lines has taken place in modern times than the development of grinding. The field of the old grindstone was limited, and the sharpening of edged tools was almost its only use.

The introduction of the emery-wheel, however, made grinding a very important operation. The emery-wheel has not only rapidly replaced the grindstone, but in many operations the work of the cold chisel, the lathe-tool, the file, and other steel-cutting toools is now done more efficiently by grinding.

Before the invention of the electric furnace, artificial abrasives suitable for grinding-wheels were unknown. Wheel manufacturers necessarily depended upon natural products,—chiefly corundum and emery. As emery occurs in considerable quantities in various parts of the world, it came to be recognized and used as the chief raw material for grinding-wheels and other products employed in grinding metals. On this account the modern grinding-wheel made of any abrasive is popularly known as the "emery-wheel."

The invention of alundum is the latest of the important electro-chemical inventions, which during the past few years, have attracted so much attention and made Niagara Falls the centre of electro-chemical industry in the United States.

The introduction of alundum in the field of grinding has been remarkably successful and rapid. The requisites sought for and attained in this abrasive are extreme hardness and sharpness, combined with uniformity and proper temper. So successful has been its development that alundum has become known as the standard of high quality and uniformity as an abrasive.

Process of Manufacture.

The process of making alundum consists in taking the purest amorphous oxide of aluminum found in nature, known as the mineral bauxite, purifying and melting it in the electrical furnace in a large, homogeneous bath or fluid mass. Upon cooling this molten fluid solidifies and crystalizes in solid masses of alundum of great purity and absolute uniformity throughout.

Bauxite, the raw material from which alundum is made, is the purest naturally-occurring amorphous oxide of aluminum known. This mineral was originally found at Baux, France, from which it derives its name, but purer forms are now obtainable in the United States. The best quality only is used in the manufacture of alundum and in its preparation practically all impurities are removed. The higher grades of bauxite used are of rare occurrence. The Norton Company, however, owns its own mines from which the purest grade is obtained.

The bauxite is heated in large preliminary heating furnaces to drive off the combined water, and is then melted directly in electric furnaces of special design. Beauxite was considered infusible until the invention of this process, no heat of combustion being able to melt it, the electric are only being equal to this task.

Eleven electric furnaces have been installed, each capable of producing three tons of alundum every twenty-four hours. Electric power necessary to melt these large charges into solid, uniform ingots of alundum is produced by the Falls of Niagara, and is furnished by the Niagara Falls Power Company.

The temperature at which the furnace charge melts into one homogeneous mass, is above the limit by which temperatures are measured by any means known to science, and is variously estimated between 6000 degrees and 7000 degrees Fahrenheit.

The operation of these furnaces and the composition of the molten bath is under the control of the furnace operator. Exact quality and uniformity which is so important in steel manufacture, is fully as important in the grades of steel are now being made in electric furnaces similar in design to alundum furnace, because impurities can be removed at the high temperatures obtained by the electric arc, and the quality of the molten bath uniformly maintained. In the alundum furnace both the purity and uniformity of the alundum is assured. Each step in the process is under the close supervision of expert chemists, who are constantly directing and following the work by careful analyses in our own chemical laboratory.

The large masses of molten bauxite are allowed to cool and crystallize in great ingots of purified crystalline alundum. Beautiful crystals are found in the centre of these masses, showing nearly all the variety of colors found in the ruby and sapphire, of which alundum is the commercial, artificial product. The rarer colors of light pink, blue and purple found in the rarer oriental gems are sometimes noticed in small crystals. The ingots of alundum are broken up into small pieces by means of powerful crushers. It is then passed through series of rolls to reduce it to the various sizes of grain, which are finally separated by passing over sieves of different mesh to prepare it for manufacture into Norton grinding wheels, rubbing and sharpening stones, and other articles.

The solid massive alundum. While resembling the purest natural corundum in chemical composition, has the remarkable quality of being considerably harder than the natural product. This is due to the perfectly fluid condition in which the mass is melted, the control of its composition, the rate and method of its cooling and crystallization by which it receives its temper, the absence of water of combination (which almost invariably exists in natural corundum), and the pure and even state in which the fluid mass crystallizes.

The process of manufacturing alundum is patented, being thoroughly protected by United States and foreign patents, both in process and apparatus. These patents are owned and controlled by the Norton Company exclusively.

Effective Qualities.

The necessary requisites for the most efficient abrasive for grinding wheels are :—

1st.—Sharpness.
2nd.—Hardness.
3rd.—Right Temper.
4th.—Uniformity.
5th.—Abundant supply.

To have sharpness in order to obtain the most satisfactory results,—so far as rapid and continued cutting is concerned,—a peculiar quality is necessary There must be a fracture which will give a number of sharp-cutting points. This is obtained in alundum to better advantage than in any other abrasive material.

In the matter of hardness the recognized standard is the diamond, which is No. 10 in the scale of hardness; nothing that man has yet discovered or made equals the diamond in hardness. The term "hardness" is, therefore, a comparative term, the hardness of a mineral being ascertained by its ability to scratch another mineral of a known degree of hardness, or to be scratched by such a mineral.

Pure crystaline corundum, represented by the best sapphire or ruby, has always been the standard for No. 9 in the scale of hardness. This is readily scratched by alundum ; in fact, alundum powder is used for cutting and drilling rubics and sapphires for watch jewels, etc.

After numerous careful tests, comparing alundum grains with other abraisive grains, including the diamond, alundum is found to exceed 9 1-2 in the scale of hardness where the diamond is 10.

By "temper," is meant its strength of grain and the character of its fracture under grinding pressure. An alundum grain is remarkably tough, and will stand more crushing pressure before breaking than any other abrasive grain, but when it does break, it breaks with a sharp, crisp fracture, giving a fresh keen-cutting edge. This is a most important quality in an abrasive.

The purity and uniformity of alundum far surpasses that of any other abrasive. Purity, besides resulting in greater hardness and better temper, is necessary in the bonding of the grain into wheels in order to secure accurate and uniform results, and uniformity is necessary to secure constant efficiency and accuracy of grade and temper in a wheel, so that wheels can be accurately duplicated at any time and maintain their standard of work.

Uniformity is one of the most important requisites in an abrasive. The ability to duplicate a grinding wheel is essential to efficient results from its use. In grinding wheels the abrasive grain of given size is bonded together to produce a certain grade or temper for a certain kind of work. This means that the bond which holds the grains together must be harder or softer, according to the particular work required of the wheel. Different grades are required for different materials to be ground; cast iron, steel, brass, glass, bone, leather, wood and other substances demand wheels of special grade which must be duplicated to make the grinding operation continuously efficient.

It is for this most important reason that great stress is placed on evenness in quality of the abrasive itself. Grades cannot be duplicated accurately without having a known and dependable factor in the uniformity of the material composing the wheel; and this important requisite is to the highest degree found in alundum.

Alundum and the process of making it, were awarded the Grand Prize, at the St. Louis, Exposition. The individuals responsible for its invention and development were honored with diplomas and medals for their part in this most notable, practical invention.

Companies Incorporated

The Commercial Cement Company, Winnipeg, were incorporated with a capital stock of $150,000.

The Leitch Collieries, Limited, capital $1,000,000.00, propose to develop mining properties and operate same. Head office, Ottawa, Ont.

The Rogers Mfg. Co., Limited, propose to manufacture lubricating devices for journal boxes, capital $200,000.00. Directors: A. F. Ritz, A. E. Dancey and A. J. Stanford. Head office, Toronto.

A. R. Rogers Lumber Co., Limited, capital $500,000.00, propose to carry on the business of lumbering and a general mercantile manufacturing and contracting business. Head office, Winnipeg, Man.

St. Joseph Transportation Co., propose to construct a canal so as to create a navigable waterway somewhere on the eastern shore of Lake Erie, in the county of Elgin and to maintain same.

A firm has been incorporated under the name of Western Fire Clay Products, Limited, Winnipeg, with a capital stock of $600,000 for the purpose of manufacturing brick, tile, pipes, and all articles manufactured from clay.

The British Canadian Engineering Co., Limited, capital $250,000.00, propose to carry on the business of mechanical and electrical engineers and iron founders. Directors: J. I. Sutcliffe E. S. Sutcliffe and R. Williamson. Head office, Toronto.

The Marvel Acetylene Generator Co., Limited, share capital $10,000, propose to instal acetylene plants and deal in gas fittings. Directors are: A. J. Moore, F. W. Moore, A. E. Scanlon, C. W. Ellis and Chas. Wilson. Head office, Bradford, Ont.

The Nipissing Power Co., Limited, capital $100,000.00, propose to generate power to supply to the several municipalities in the vicinity of Lake Nipissing. Provisional directors are: Alice Scott, E. R. Lynch and J. P. Crawford. Head office, Toronto, Ont.

Automobile and Sportsmen Exhibition, Limited, share capital $20,000.00, propose to conduct exhibitions of automobiles, motor boats, motor engines, etc. Directors: Robert Jaffray, Stanley Jackson and Robt. McKay. Head office, Montreal.

A charter has been granted The Volcanic Oil & Gas Co. of Chatham, who propose to produce and make petroleum and natural gas. The share capital is $300.000. The provisional directors are D. A. Cash, Port Colborne; H. D. Symmes, Niagara Falls and J. T. O'Keefe, Chatham.

Gravel and Duhamel, Montreal, have been incorporated with a total capital stock of $99,000, with P. Gravel, J. G. Duhamel, J. A. Barrette, V. Laperte, all of Montreal, for the purpose of manufacturing iron goods, hardware, carriager, furniture, saddlery, as well as to develop hydraulic and steam power.

A company has been incorporated at Ottawa, as the Crude Oil, Gas and Power Company, with a share capital of $100,000, for the purpose of producing and dealing in gas of all kinds, motive power, heat and light. The head office will be at Windsor, and the directors are W. H. Leith and H. J. Booth of Detroit, and C. L. Meyer, Windsor.

The Canadian Refining Company, Ottawa, has been organized with Dominion charter to refine and smelt minerals. The capital stock is placed at $2,000,000 and the provisional directors are:—H. Ray, Ottawa; F. W. Rolt, Rossland, B.C; J. Jean Baptisti, Notre-Dame-de-Standridge, Quebec; E. Hoffman, New York; R. Dieffenbach, New Jersey; J. J. Fleulot, Frank, Alberta.

The Ontario Nickel Company has been incorporated with a capital of $1,000,000, with head office at Worthington, Ont., for the purpose of mining, milling, and developing mines. The Canadians among the applicants for incorporation were, W. S. Tates of Worthington, Ont.; H. H. Dow, W. L. Baker, Midland, Mich.; A. E. Corners, and T. E. Collings, Cleveland, Ohio.

The Leach Concrete Company has been incorporated with a share capital of $10,000, with head office in Toronto, for the purpose of carrying on a business as concrete contractors and builders, and to manufacture plain and reenforced concrete, for structural and engineering works, and fire proof buildings. The directors of the company are R. Leach, W. Leach, R. W. Eyre, E. E. Wallace and H. M. Sinclair, all of Toronto.

Why, Indeed.

Like true British workmen, they were not, for the moment, doing anything particular. Some were smoking pipes and lounging about with their hands in their pockets, on a site chosen for the erection of some new houses.

"I can't allow this idling," said the builder, coming up full of importance and ideas. "Come along ; set to work!"

"Can't go on, sir," replied a bricklayer, looking at his trowel with tender solicitude and affection ; "we ain't got no plans yet!"

"Plans?" echoed the builder, with scorn ; never mind about plans. Put a kitchen here," he explained with a wave of his hand, "and a parlor there," pointing near to the imaginary kitchen ; "they're bringing in the furniture next week. What's the good of wasting time. Get a move on you, men!"

The Ready Remedy.

When trouble after you doth chase,
Why, turn and stare her in the face
And smile.
And she will hurry from your sight ;
A smile will fill her full of fright,
So smile.
When worry hustles after you
And dyes the world a sombre hue,
Just smile ;
A grin will drive her far away.
So let your laughter muscles play
And smile.

Industrial Progress

CANADIAN MACHINERY AND MANUFACTURING NEWS would be pleased to receive from any authoritative source industrial news of any sort, the formation or incorporation of companies, establishment or enlargement of mills, factories or foundries, railway or mining news, etc. All such correspondence will be treated as confidential when desired

At Sydney, N.S., a technical school has been opened.

A new leather goods factory has been started at Brampton.

Turpentine works will shortly be established at Killaloe, Ont.

A Chatham firm will erect a large stair mill, at Rainy River.

A new woollen mill to cost $25,000 is to be erected at Lethbridge.

A breakwater, is to be built at Port Arthur, at the cost of $350,000.

A new factory to manufacture clothing has been opened at Oakville.

Vancouver will spend $150,000 on new school buildings and sites next year.

The Dowswell Mfg. Co. is erecting an $8,000 addition to its plant in Hamilton.

The Scott Lumber Company, are building a lath mill at Fredericton, N.B.

The Polson's Iron Works, Toronto, are to build a steel workshop to cost $25,000.

The Sharples Separator Company, Toronto, have erected a $15,000 brick factory.

Fort Frances is to have a new street water tower with a capacity of 100,000 gallons.

Goderich may install a producer gas Engine in connection with their electric light plant.

The J. H. Ashdown Hardware Co., of Winnipeg, will erect a branch warehouse in Calgary.

C.P.R. machinists on the eastern lines, have been granted a ten per cent increase in wages.

The York and Sunbun Milling Co. of Gibson N,B., will erect another large saw mill at that place.

Asbestos is said to have been discovered in South Africa, equal to the finest Canadian product.

The name of the Toronto Contracting & Paving Co. has been changed to the Orpen Co., Limited.

The Northwest Threshing Machine Co. of Stillwater, Minn., will build a large warehouse in Brandon.

Work on the Toronto Type Foundry's new plant at Toronto Junction, is rapidly nearing completion.

A one storey brick factory is to be erected for the Toronto Plate Glass Company, to cost $16,000.

The enormous amount of business done this summer is in evidence on every hand, and the railways and lake shipping report a banner year.

A contract has been let for the erection of a new building at Walkerville for the Dominion Dash Co.

A Birmingham small arms company are sending a representative to Canada to establish agencies here.

The National Spring and Wire Co., will locate in St. Catharines, where they have leased a factory.

The Massey-Harris Co. has taken out a permit for a $15,000 extension to their main building in Brantford.

The Dunlop Rubber Company, Toronto, are erecting a two-storey brick rubber factory, to cost $18,500.

The buildings of the Rapid Tool Co., at Peterboro, have been completed, and machinery is now being installed.

Mr. F. W. Bauer, Montreal, has been appointed secretary-treasurer of the General Supply Co., of Ottawa.

The Chapman Double Roller Ball Bearing Co. is erecting a $10,000 factory on Sorauren avenue, Toronto.

The American Metal Co., of Winnipeg, has sold out, and the Detachable Boiler Flue Mfg. Co. has been incorporated.

An Indiana firm is to erect a fifty thousand dollar plant at Guelph, for the manufacture of brick-making machines.

The Meisel Manufacturing Co. will build a plant at Port Arthur for the manufacturing of harvesting machinery.

The Gibson Manufacturing Co., Port Washington, Wis., has been granted a fixed assessment of $5,000 to locate in Guelph.

The International Portland Cement Company, Hull, Que., made a record shipment of 300 barrels in one day recently.

The contract has been issued for the building of the new Terminal Station at Hamilton. The cost will be about $230,000.

A permit has been issued the Canada Cycle and Motor Company, for a $4,000 addition to their factory at Toronto Junction.

The Walter's Lumber Co. of Strathcona, has taken out a permit for the erection of a $15,000 saw mill at Edmonton.

A hydraulic plant has been installed two miles out of New Liskeard, to supply that enterprising town with light and power.

Tolden, B.C., is to have one of the largest saw mills in the country with a cutting capacity of 50,000,000 feet in a season.

Sherwin Cooper & Company, manufacturers of gasoline engines, have secured a factory site on the Don Flats in Toronto. They will employ 50 to 75 men.

The Sydney Cement Company have closed down on account of not getting the regular supply of slag from the Steel Company.

Jones Bros., manufacturers of barber-shop and bar fixtures, Toronto, have purchased the plant of the Dundas Refrigerator Co.

The Ross Rifle Co., Quebec, are looking for a location in Ontario for the removal of their plant for manufacturing sporting rifles.

Mr. W. C. Rankin, of the Carborundum Co., Niagara Falls, N.Y., was a recent visitor at the Montreal office of "Canadian Machinery."

The Canadian Art Iron Works Company, Welland, Ont., will erect three buildings to cost $15,000, and will employ fifty men.

The cement mill at Longue Point, Que., is being enlarged, and when finished will have an output of about 4,000 barrels per day.

It is expected that a big rolling mill will locate at Sydney, N.S., to manufacture articles used in building and railway construction.

Representatives of the Dominion Steel Co., of Sydney, C.B., have been in Port Arthur with a proposal to establish a wire works there.

The Union Bank has bought the lot at the corner of May and Victoria streets, Fort William, for the erection of a branch in that town.

The Sutherland-Innes Co., Chatham, are to establish a stave plant, not a stove foundry, at Rainy River, Ont., as reported a week ago.

The Canadian Port Huron Company, with offices at Winnipeg, will build a new warehouse in Calgary, to be used as a central distributing point.

The ratepayers of Alvinston, Ont., will vote on a by-law to loan $6,000 to J. Smith for the establishment of a basket and nail-keg factory in that town.

The Dominion Bearings Company, have purchased a block in St. Catharines, and are installing machinery for the manufacture of Wright roller bearings.

Contracts for improvements to the power plant of the Lake Superior Corporation at the Michigan Soo, amounting to about $1,000,000, are being let.

Gaar, Scott & Co., Richmond, Ind., large manufacturers of thrashing machinery, will locate a factory in Western Canada, probably at Winnipeg.

A company has been formed at Petrolia, Ont., for the purpose of handling ex-

plosives for drill purposes, and to bore for oil, gas and other minerals of all kinds.

The Canadian Clothespin and Woodenware Manufacturing Co., will erect a new factory in Renfrew, Ont., where they will begin operations early in January.

Harvey Graham, Assistant General Manager of the Nova Scotia Steel & Coal Company, is undergoing medical treatment at the General Hospital in Montreal.

The Brantford Folding Paper Box Company has been sold to C. R. Somerville of London, who will continue the business in Brantford for the present.

The C.P.R. has placed an order for half a million Bartley nut locks with the J. A. Young Co., Montreal. This number will be sufficient to equip 250 miles of track.

The Tilson Manufacturing Co., of Port Washington, Wisconsin, have decided to locate their Canadian branch in Guelph, where they will manufacture gasoline engines.

The Grand Trunk Repair Shops will locate at New Toronto, where they will manufacture all steel switches and diamond crosings used on the whole G.T.R. system.

Work on the mountain drain improvements at Hamilton is being rushed, but there is little prospect of completing it this year. Scarcity of labor is one of the main drawbacks.

The Rhodes, Curry Co., car builders of Amherst, N.S., claim they were never so busy at at the prescnt time, and the shops have to work night and day to keep up the stock.

Messrs. Heney & Miller, builders and contractors, Toronto, will open a branch office in Woodstock for the sale of builders supplies and machinery, stone, cement, sewer and field tile.

The North Ontario Reduction & Refining Co. have commenced work on their new plant at Sturgeon Falls, which will be in operation next Summer with a capacity of 100 tons per day.

At Sydney, N.S., the council have decided to give a bonus of $50,000 to a firm manufacturing railway supplies and Mowry bolts. The plant will cost $400,000 and work will be given to 250 men.

The Nelson, B.C., Iron Foundry has made two good three-year contracts with British Columbia Smelter companies, and business is so good that a branch shop will be opened at Greenwood, B.C.

Building has been started on the plant of the Lehigh Portland Cement works near Belleville. It is claimed by this time next year they will be turning out cement at the rate of 50,000 barrels a day.

Building permits to the amount of half a million dollars, were issued in Stratford this year. The by-law to guarantee the bonds of the Kemp Manufacturing Company, was carried and the above company take over the old Kemp factory, heretofore occupied by the Massey-Harris Company, and will manufacture agricultural implements.

Guelph is to have a new factory. The Standard Knitting Company has been secured. The Anton Berg & Son Company have asked for a loan of $25,000 which will be decided upon by a vote of the citizens.

The mica works which have been operated in Smith's Falls for the past three or four years, are being removed to Ottawa. The reason given for leaving is that they cannot get enough female laborers.

Kelly Bros. & Mitchell, of Winnipeg, have been awarded the contract for the erection of the new building in Vancouver for the Canadian Bank of Commerce. The cost will be in the neighhood of $400,000.

The Dominion Iron & Steel Co., of Sydney, N.S., state that they can manufacture cement from slag much cheaper than it can be manufactured of marl in Ontario. They are going after the Northwest market.

The Prince Albert, Sask., Board of Trade, may ask Ames Holden Co., shoe manufacturers Montreal, to establish a branch there. It is also suggested that a by-law be passed granting the C.N.R., a bonus of $25.000.

The John Morrow Machine Screw Company, Ingersoll, have purchased the plant of the Standard Bolt & Screw Company, Toronto, valued at $28,000 and will be taken to Ingersoll to supplement the plant there.

The Silvia Brick & Lime Co. Victoria B.C., have opened a $30.000 plant, capable of turning out 20,000 brick per day, and $10.000 will be expended in machinery for refining raw lime, with a daily capacity of 200 barrels.

The Canadian Westinghouse Company have been awarded a contract for apparatus to be used in the new power station on the Voulager Canal on the St. Lawrence River, to supply Montreal with heat, light and power.

A coal famine is reported in the West, owing to the shortage of cars. Winter has set in, but it will likely be some time before the supply is to hand. The coal mines at Medicine Hat have been reopened as a result of the scarcity.

Westport, N.S. ratepayers will vote on a by-law granting a bonus of $4,000 to the New Idea Buckle Co., to establish a factory in that village for the manufacture of saddle and harness, hardware and other malleable work.

Copper has been found in Hastings County near Belleville in paying quantities. 150,000 pounds of pure copper has been extracted so far. The Medina Copper Company will take over the property and work will be rushed along.

A contract has been given by the Chicago and St. Lawrence Steam Navigation Co. to the Canadian Shipbuilding Co. for a steel freight steamer to be 510 feet long over all, 500 feet on the keel, 56 feet beam, and 31 feet deep.

The concrete foundation for the new steel water tower which the Town of Fort Frances, Ont., is erecting in connection with its waterworks system, has been commenced. The tower will be 92 feet high, with a capacity of 100,000 gallons.

The Sussex Mfg. Co. have amalgamated with the Taylor & McKenzie Co., of Guelph, Ont., who will move their machinery to Sussex, where they will manufacture furniture, refrigerators, etc., and will be known as the Sussex Manufacturing Co.

The Canadian Pacific Railway Co. are to construct a new building on Osborne street, Montreal, at a cost of $38,000. The building will be used as an express office, and will be 176 feet long by 87 feet deep, two storeys high and concrete throughout.

Work on the 30 new dwellings for the employes of the Ontario Iron & Steel Co., at Welland, is being rushed by the Welland Construction Co., who have the cantract. Fifteen of the houses are to be finished by Jan. 1, and the remainder by the 1st of March.

The White Company has been awarded the contract for building the terminal station for the Cataract Power Company at Hamilton. The building will cost $200,000 or $250,000, and will be the terminus of the electric lines concontrolled by the company.

The Atikokan Iron Company, at Port Arthur are busy on the construction work of their new plant, which will cover an area of forty acres, containing 100 coke ovens which will make 200 tons of coke per day, and a furnace producing 100 tons of iron per day.

Goderich ratepayers have carried two important by-laws. One to loan $50,000 to the Goderich Wheel Rigs Co. to assist in erecting a $100,000 factory for the manufacture of baby carriages, etc. And the other to assist the Jackson Clothing Co. by supplying electric motive power.

The Harbison-Walker Refractories Co., Pittsburg, Pa., has taken over the selling organization of the Portsmouth Harbison-Walker Co., and in the future all brands of brick, etc., made by the Portsmouth Harbison-Walker Co. will be sold by the Harbison-Walker Refractories Co. direct from its Pittsburgh offices.

The Lake Superior Corporation, Sault Ste. Marie, Ont., will build an addition of 500 feet to its ore dock as the steel plant dock, which is now 900 feet in length. An additional blast furnace is also being considered by the directors, the furnaces now in operation being unable to supply enough pig iron for the plant.

The Electric Development Company, started a unit of their power plant at Niagara Falls on Nov. 3. When the headgate was opened and the water filled the long penstock the twelve thousand horsepower turbine wheel began to spin as smoothly as a top, and the biggest vertical electric generator ever started in the world was put in motion.

Preliminary work on what is expected to be one of the biggest coal docks in the district of the lakes was started at Detour, near the Soo, yesterday. The dock is to be 1,000 feet long, 300 feet wide, and the estimated cost, with machinery complete, is $400,000. Several boats at a time will be able to coal there. Construction will be started in the Spring.

Building permits amounting to $250,000 were issued in Toronto from November 10, to November 17, inclusive. The permits include 55 houses, a warehouse for oil storage, by the Canadian Oil Company, to cost $5,000, a workshop for corrugated iron at the foot of Peter Street, to cost $2,000, and a charging station for the Commercial Acetylene Company, to cost $2,000.

The Hawkeye Co., manufacturers of trip hammers, Cedar Rapids, Iowa, are about to start manufacturing in Canada. Their goods have been on the market in the United States during the past five years, and are already known in the Canadian market. Mr. F. F. Davidson, of the Hawkeye Co., was in Toronto recently with a view to making the necessary arrangements for manufacturing the trip hammers.

The Canadian Copper Co., of Copper Cliff, has bought from Allis-Chalmers-Bullock, Montreal, a pumping plant consisting of an eight-inch single stage turbine pump driven by a 70 h.p. induction motor. The Calumet Mining and Milling Co., Calumet, Que., has increased its plant by a 12¼ by 18 inch "Ingersoll" air compressor driven by a 50 h.p. induction motor, both bought from Allis-Chalmers-Bullock, Montreal.

The Dominion Iron and Steel Company, Sydney, N.S., has contracted with the Nova Scotia Coal and Steel Company for the output of their coke ovens until the first of January, by which time their own blast furnaces will have started. This, in addition to the output of the Steel Company's own ovens, will enable them to start the second blast furnace, probably by the end of the week.

The Shipway Iron Bell and Wire Manufacturing Co., Toronto, are asking the Council at Niagara Falls for a free site, electric energy up to 100 horse-power at $10 a year per horse-power, low rates for water, gas, and fixed taxation for ten years. In consideration of this would move to Niagara Falls, extend their factory and employ 50 to 100 men. The proposed stock of the company is $150,000.

An effort is being made to bridge over the difficulties between the Dominion Coal Company and the Dominion Iron & Steel Company. The former company is closing down four of its collieries, owing to the steel plant's idleness and the approach of the close of navigation of the St. Lawrence route. The Bank of Commerce is heavily interested in the Steel Company and Senator Cox is on the directorate of both companies. Sir William Van Horne has retired as a director of the Coal Company owing to his large interests in the Steel Company.

The new factory of the McGlashan, Clarke Co., at Niagara Falls, Canada, is now in operation. The site of the factory is on the direct line of the Michigan Central Railway, and the main building is 70 x 300 feet. It is equipped with the latest machinery. Electric power is used throughout. Flat ware and cutlery, both in silver and nickel-silver, are being manufactured. The officers of the company are: E. G. Clarke, president; J. G. Cadham, vice-president; Lee McGlashan, general manager, and S. Woods, secretary and treasurer. John C. McCain is superintendent.

An important development in the industrial world recently, has been the purchase by the Canadian Consolidated Rubber Co., Montreal, of the Maple Leaf Rubber Co., who operate a large plant at Port Dalhousie, Ont. The paid up capital of the Maple Leaf Co. was $350,000. The purchase was a cash transaction. Although the output of the Maple Leaf factory is confined to rubber footwear, several hundred hands are employed, and a large business is being done in these lines. The Montreal concern has already assumed control of the Maple Leaf factory, and its capacity will be considerably increased in the near future.

The Billings & Spencer Co., of Hartford, Conn., have definitely decided to extend their operations to Canada, and have formed a Canadian company for this purpose, to be known as the "Canadian Billings & Spencer," with a capital of $200,000, Mr. Billings, of Hartford, being its president. The Billings & Spencer Co. are the largest and oldest established company making drop forgings in the United States, and are also manufacturers of all kinds of drop forging machinery. They have secured as general manager of the Canadian company, J. Gill Gardner, at present manager of the steel and forge department of the James Smart Mfg. Co., of Brockville, Ont. The location of the plant has not yet been finally decided.

In referring to New Zealand's new tariff J. S. Larke, Canadian commercial agent in Australia, reports that in the case of bicycles, wagons, perambulators, fancy goods and toys, hardware, lamps, pianos, plateware and pumps, the United States will have to pay 30 per cent., while Canada and Britain will pay 20 per cent. On footwear the United States will have to pay 33 3-4 per cent. and Canada 22 1-2 per cent. In hops the United States will pay 9d, Canada 6d; nails, United States, 3s, Canada, 2s per cent.; furniture, United States 37 1-2 per cent., Canada 25 per cent.; wall paper, United States 22 1-2 per cent., Canada 15 per cent.; wrapping paper, United States 7s 6d, Canada 5s per cent., bicycle parts, gas and oil engines, gum boots, printing paper, rails, sailcloth, canvas, surgical and dental instruments, United States 20 per cent., from Canada and Britain free.

The Dominion Iron & Steel Co., Sydney, N.S., were forced, Nov. 3, to stop their blast furnaces for the lack of coke. The trouble appears to be over the supply of coal for the manufacture of coke. The steel company contend that they were being supplied by the coal company with an inferior quality. This became so pressing that they began the importation a few months ago of a supply from the Nova Scotia Steel & Coal Company at Sydney Mines. They brought over 30,000 tons, and have ordered more. This coal cost them considerably more at the plant than the Glace Bay product, and the company, it is understood, charged the Dominion Coal Co. with the difference in cost. President Ross refused to pay this, and went further by practically shutting down their supply. Such is the common version of the cause of the difficulty.

The Dominion Iron & Steel Co. made a great record during October. The quantity of steel ingots turned out in the thirty-one days exceeds by 2,825 tons the best previous output for any corresponding period. The output of the various departments was: Coke, 34,400 tons; pig iron, 23,325 tons; ingots, 25,425 tons; blooms, 22,553 tons; rails, 12,621 tons; rods, 5,214 tons. During the month three blast furnaces were operated. The blooming mill and rail mill worked double shift, while the billet mill and rod mill were on single shift. Of the various materials finished for market 16,500 tons were shipped, and, in addition, about 5,000 tons of rails were stocked. These will be loaded on the steamship "Bergenhus" now in port. Over 125,000 tons of ore and limestone were brought in, and the tonnage of materials handled in and out amounted to over 200,000 tons.

The United States Steel Corporation has perfected plans to dominate the Portland cement industry of the United States. This step is in keeping with the modern tendency of big corporations to utilize every ounce of by-products. The steel corporation will make use of its slag, which has heretofore been of practically no value, and by this means it is hoped to add materially to revenue. The demand for cement is growing at a rapid rate, and the industry is regarded as a peculiarly profitable one for the steel trust, with its unrivalled facilities, to engage in. Official announcement is made of the plans by which the steel corporation not only will control the Portland cement industry in Chicago, but will invade the east by building a plant near Pittsburg. The Universal Portland Cement Company, capitalized at $1,000,000, took over on October 1 the plants and business of the cement department of the Illinois Steel Company. It is planned to increase the output of cement by nearly 150 per cent. by the erection of a new plant near Pittsburg. To do this $3,000,000 will be expended—taken from an appropriation made by the management of the steel corporation last Spring. When the plants are completed the yearly putput will be about 6,000,000 barrels and will exceed by 10 per cent. that of the entire country. This will give the corporation the premier position in the industry, and it is probable that other plants will be started to keep pace with what is expected to be a rapidly growing demand.

Activity at Collingwood.

The Northern Steel & Iron Co.'s mills at Collingwood are working successfully after over a month's operations and 125 men are kept busy in the day and night turns making bar, car and track

iron on orders for the Canadian General Electric, Canadian Car, Toronto Railway and Grand Trunk Railway Companies. The output will be doubled by the addition of two new furnaces which will be ready about December 1.

The Imperial Steel and Wire Co.'s plant is also in successful operation, the output having been increased 15 per cent. recently with the same equipment. "The shortage in wire billets and in railway cars is both helping to make the wire nail market firmer and with base prices at $2.10 in both New York and Chicago and $1.95 in Pittsburg, it looks as though we will see $2.25 asked for wire nails before many weeks," said Major Currie, president of the Company this week.

Large Mineral Production.

Returns made to the Bureau of Mines give the output of the metalliferous mines and works of Ontario for the nine months ending 30th September, 1906, as follows:—

	Quantity.	Value.
Gold, ounces	2,015	$ 34,377
Silver, ounces	2,542,827	1,609,554
Cobalt, tons	138	110,400
Nickel, tons	8,037	2,856,233
Copper, tons	3,900	600,000
Iron ore, tons	93,159	117,466
Pig iron, tons	208,094	3,194,200
Steel, tons	123,257	3,059,070
Zinc, tons	300	4,500
Arsenic, tons	691	13,830

These figures show a considerable advance over those for the same period of 1905, and indicate that the production for 1906 will be much the largest of any year in the history of metalliferous mining in Ontario. The silver, cobalt and arsenic given in the above table are all the product of the Cobalt silver field. The nickel entirely and nearly all the copper are from the Sudbury district, and the iron ore is the product of the Helen mines at Michipicoten.

New Machinery at Belleville.

The Belleville Rolling Mills, which started operations recently, is running to its full capacity during the day hours, but will not run at night for the present. The plant comprises three rolling mills, 18, 12 and 9 inch, and a fully equipped machine shop. An up-to-date horseshoeing department is under construction, and a large cement cistern has been built near the proposed dock. Much new machinery has been installed during the past summer. One machine the "Squeezer," makes it possible for the mills to economize greatly in the matter of labor. Big piles of scrap go into the furnaces, come out in a molten condition, and then go into the "squeezer," from which they come in the shape of a big red-hot ball. This ball goes to the "rollers" at the 18-inch mill, and is gradually worked along till it becomes bar iron. The "squeezer" weighs 80,000 pounds. The new shears purchased in Pittsburg weigh 100,000 pounds, and will shear iron six inches thick. The lack of such shears as these militated greatly against the successful operation of the mills in old times.

Want Electric Power.

With the first delivery of electric energy from Niagara to Toronto, the question of power for the various municipalities has received considerable impetus. From all over the province requests have been coming in from various municipalities to the Hydro-electric Commission for power, showing the popularity of this movement, forty-six in all have asked for electrical energy, totalling 125,000 h.p. in lots varying from a few hundred horse power to 30,000. Hon. Mr. Beck states that these will all be supplied in accordance with their requests. The amounts required by some of the municipalities are as follows:

	H.-P.
Toronto	30,000
Toronto Junction	10,000
London	10,000
Berlin	3,000
Galt	2,500
Woodstock	1,200
Guelph	3,000
Preston	800
Waterloo	900
Stratford	5,000
St. Mary's	2,000
Paris	1,000
Hespeler	750
Brantford	3,000
Orangeville	1,000
Parkhill	500
Leamington	250
Brampton	1,200
St. Thomas	1,500
Lucan	300
Cottam	500
Tilsonburg	1,000
Milton	500
Ingersoll	1,350
Acton	800
Norwich	200
Windsor	5,000
South Dumfries	3,000
Simcoe	500
Elmira	600
Dundas	3,000
Strathroy	225
Richmond Hill	100
Walkerton	1,500
Harriston	400
Durham	2,000
Hamilton	15,000
Total	113,575

The applicants in other districts are:

	H.-P.
Belleville	3,200
Chatsworth	50
Thedford	50
Bayfield	150
Ottawa	3,000
Brockville	1,000
Steelton	1,000
Port Arthur	2,000
Stanley	50
Total	10,500

Welland's New Steel Plant.

The Ontario Iron & Steel Company has, under course of erection at Welland, Ontario, a plant for the manufacture of open hearth steel billets, bars, angles and light rails, and for the production of steel castings in size varying from one pound to ten tons. Their site covers sixty acres of ground with a frontage on the Welland Canal and track connections with the Grand Trunk, Wabash, Michigan Central, Canadian Pacific and T. H. & B. Railways. A dock is to be constructed on the canal front, which will enable the company to economically handle their raw material by water. The Canadian Government has at present under construction a turning basin in the canal just below the property of this company, which will enable large steamers, coming in from Lake Erie, to discharge their cargoes and return again to the lake without entering the canal locks—the company's dock being located on the Lake Erie level.

J. A. Herrick, M.E., of New York, has the furnace construction in hand, and W. J. Bradley, M.E., of Troy, has in charge the rolling mill construction. Robert Porter, late of the riverside department of the National Tube Company, is to be works manager, while the foundry plant will be in charge of Daniel J. Blaney. The head office will be in the Traders' Bank building, Toronto, the President of the company being W. W. Near, of the Page Hersey Company, Guelph, and the Secretary, H. Rooke.

The buildings are to be the following dimensions: Open hearth building, 85 x 175 feet; rolling mill building, 119 x 300 feet; foundry building, 150 x 165 feet. The buildings are to be equipped with travelling cranes built by the Niles-Bement-Pond Company, and operated with alternating current motors. Power to run the works is to be furnished by the Ontario Power Company, Niagara Falls, Ontario.

The company controls its own natural gas wells, which will be used for furnishing fuel for the furnaces. The rolling mills will consist of 3 high 12 and 22 inch trains, to be driven by alternating current, 2,200 volt motors. The open hearth department will consist of two 25 ton open hearth furnaces, and the foundry department of one 20 ton open hearth furnace. The 22-inch train will be served by a continuous ingot furnace and the 12-inch mill of two heating furnaces. The object being to make the operation of the mills as nearly continuous as possible.

The company expects to be making steel early in spring, and to have the plant in full operation by the 1st of July, next, but the difficulty experienced by buyers in getting iron and steel may make this impossible.

New Stove Foundries.

The Sutherland Innes Company of Chatham, Ont., have purchased a site and will locate a stove foundry at Rainy River, Ont. They will employ 35 hands and stock and plant will cost $15,000.

The new buildings for the Supreme Heating Company's stove foundry have been commenced at Welland.

HOARDING OLD METALS.

Most of those who have had a long experience of the trade in old metals are aware that a miserly habit of hoarding often takes possession of the men who collect copper, gun metal, brass, and even old iron. In many cases it is not so much the hope of making an extra profit which induces them to hoard as the recoil from the well defined feeling of pain they experience in parting with their stock—a feeling similar in character to that of the miser who keeps his gold and starves himself to death. This feeling undoubtedly militates against the free selling of old metal, and in times of moderate prices large quantities are kept back from the market for this reason only. There must be a point in the price-movement of copper, however, when a large proportion of these old-metal hoarders can be tempted to part with their accumulations, and this point may lie between £90 and £100 per ton for standard copper. As the market approaches this level the hidden stores of old copper, gun metal, and brass should begin to return into composition. Those who remember the Secretan copper boom will recollect that an extraordinary quantity of old metal was poured into the market when copper passed the limit of £100; and taking into consideration the fact that what may be called the "latent copper supply" of the world is now five or six times as great as it was in 1887-9, there is at least the possibility of an enormous outpouring of old metal should the market price of standard be carried very much higher than it is at present. But even if such an outpouring should take place, the fact that the consumption of copper is now much greater than it was in the early eighties should prevent serious market troubles as a result of the release of large quantities of old metal. Still the possibility of their release is worth bearing in mind both by dealers in old and by consumers of new metal. —Ironmonger.

A New City..

Streets are being laid out in Prince Rupert, the Grand Trunk Pacific terminal on the northern coast of B. C. The first street which is 100 feet wide has been cleared and is being planked, in lieu of paving which will come later. Within three months the embryo city is to be lighted by electricity, is the assertion of Thos. Dunn the pioneer hardware merchant of Vancouver, who has already concluded arrangements which make him the pioneer of the new terminal city. Mr. Dunn has just returned from a visit to the new city, prior to making final arrangements to take his stock there and establish the first hardware emporium.

Some 300 acres of the new town site are now being laid out and a force of seventy men under engineer Pillsbury are busy with laying out the first sections. Other survey parties are busy making final locations for the railway line on Kaien Island, as the land is locally known, where Prince Rupert is to stand. The lines are being finally laid out, and grading will follow. At the same time Dominion Hydrographic Engineer Dodge is located at Prince Rupert for the winter, engaged on surveys of the harbor of Prince Rupert and contiguous waters. The lumber for construction of the first house which the railway company will erect has been sent forward by steamer to Prince Rupert. It is not the present intention to place lots on the market, but leases of lots for business and other purposes will be made, and the railway company will also build a number of houses and other buildings which will be rented to the first locators in the new city.

Power in Vancouver.

Completing the fourth unit of installation, the Vancouver Power Co. has just installed a Pelton water wheel which brings up the total of power generated at the big power plant on Burrard Inlet, North Arm, to 12,000 h.p. That is, for the operation of the B. C. Electric Railway's lines in this city, and the city of New Westminster, besides for the interurban line, and for power and light in both cities and adjacent suburban districts, there is now 12,000 h.p. available. It is considered that this total will not greatly exceed the demand this winter. The Company has space and power, undeveloped, to instal in all ten units, to generate a total of 30,000 h.p. The plant is located at Lake Beautiful, some fifteen miles from Vancouver on the North Arm of Burrard Inlet, where the water is conducted by great pressure pipes down to the wheels, whence it flies direct into the sea.

Mining in B.C.

The smelters and mines of the interior of the Province are in a bad way through the big strike of coal miners at Fernie, whence a large percentage of the coke for the various smelting plants comes. The Eugene mine is shipping high grade contrates to Illinois and storing low grades at the Trail smelter, which is shut down at present. The Granby smelter at Grand Forks is still running, and so is the Hall Mines smelter at Nelson, the West Canadian Collieries, with coke ovens at Lille, near Frank, having arranged to supply sufficient to ensure the smelter operating.

The Granby smelter at Grand Forks is endeavoring to increase its output again by returning to its full capacity of eight furnaces, six only having been operated for some time. Copper is now at its very highest, so that it is hardly likely a serious shut down will be anticipated. The Dominion Copper Co. is increasing its capacity at the Boundary Falls smelter by adding another copper furnace, the machinery now having arrived. The B.C. Copper Co., which has one large furnace in blast, will probably blow in the second giant furnace in a fortnight, and a third in a few weeks from that. The new furnace of the Dominion Copper Co. is to be the largest of any yet installed, though all of these big Boundary district smelters have very large equipment.

Malleable Works Leaving Branford.

Pratt & Letchworth, who have for some years conducted their Canadian branch at Brantford, doing business on a large scale, have definitely decided to leave that city and locate in Montreal. The company claim local representatives of the Lord's Day Alliance have interfered with the work that is absolutely necessary to be done on Sunday, and hence their decision. The Brantford plant was established in 1890 and has been largely extended since that time. It has now an annual output of $200,000.00, employs over 500 men steadily the year round, and pays $100,000.00 a year in wages. The plant of another company has been secured in Montreal, and although an effort is being made by the city of Brantford to retain them, the officials of Pratt & Letchworth have determined to move their entire operations to Montreal.

Percival Company's Change.

The announcement last week that the Percival Stove & Plow Company, Merrickville, had sold out to the National Manufacturing Company, of Pembroke, was a trifle premature as before the deal was closed T. H. Percival associated with Merrickville and Smith Falls capitalists, arranged to take over the business. The present works at Merrickville will be enlarged and if any move is considered Smiths' Falls will have the first opportunity.

Ontario Lead Enlarging.

The Ontario Lead & Wire Co., Toronto, have sold their white lead and putty plants and stock to the Canada Paint Co., Montreal, and their wire nail plant and stock to the Ontario Tack Co., Hamilton. By dropping out of these lines the Ontario Lead & Wire Co., will be in a position to enlarge their plumbing supply business, all the space formerly devoted to manufacturing being now available for carrying a more complete stock of enamelware and other supplies.

Ingersoll Foundry Changes.

W. J. Telford, of the sales department of the D. Moore Stove Company, Hamilton, and J. A. McCullough, formerly foreman for the Western Foundry Company, Wingham have purchased the Gobey foundry at Ingersoll and intend estimating and taking contracts for all kinds of iron castings. The new firm will be known as the Ingersoll Foundry Co., and, starting at a season when everything is brisk and lively, should soon establish themselves in a large and successful business.
sea.

Zinc Resources of B.C.

The report of the commission appointed by the Dominion Government to investigate the zinc resources of British Columbia and the conditions affecting their commercial exploitation, has been issued. The volume comprises nearly 400 pages, the contents covering a wide scope of matter, historical, statistical and descriptive of the markets for ores, cost and processes of production, mines and smelters working, methods of assaying, etc. Copies of the work can be procured from the Department of Interior, Ottawa.

PERSONAL MENTION

Mr. C. Brandeis, consulting engineer of Montreal, has been appointed consulting engineer to the British North American Lumber Company of Quebec for the installation of an extensive lighting plant.

* * *

Mr. H. Austin, Liverpool manager of Geo. Scott & Son, manufacturing chemical engineers, London, E.C., has been visiting Canada in the interests of his firm, making his headquarters with the Canadian representative, J. A. DeCew, Montreal.

* * *

Mr. George R. Burton, who has been with Lewis Bros., wholesale hardware merchants, Montreal, has resigned from the staff of that firm to become associated with the R. E. T. Pringle Co., manufacturers of electrical apparatus and supplies.

* * *

Mr. David Murphy of the Dominion Bridge Company, who has charge of the construction of the new lift lock on the Trent Valley Canal, was in Montreal recently. Mr. Murphy reports great difficulty in retaining his help, but expects to have the work finished in contract time.

Mr. W. N. Courtney, manager of the Williams Gauge Co's. Canadian branch in Montreal, has returned from a seven weeks' visit at headquarters in Pittsburg. The firm are preparing quarters at 24 St. Peter St., where they will manufacture their products for the Canadian trade. A new office has recently been opened in Toronto, at 64 Wellington St. West, to look after Ontario business.

* * *

At the annual meeting of the shareholders of the Grand Trunk Pacific held at the head offices in Montreal on Nov. 8th a new permanent board of directors were elected as follows :—Sir C. Rivers Wilson, G.C.M.G., C.B., Alfred W. Smithers, Hon. N. Charles Rothschild, Sir Henry Mather Jackson, Bart., Colonel Frederick Firebrace, R.E., of London, Eng., Chas. M. Hays, Frank W. Morse, Wm. Wainwright, E. H. Fitz-Hugh, W. H. Biggar of Montreal ; Hon. Geo. A. Cox, E. R. Wood, of Toronto ; J. R. Booth of Ottawa.

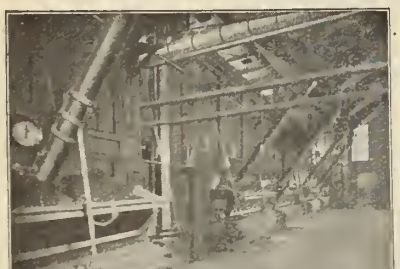
* * *

Packard Electric Gets Good Man.

Mr. H. A. Burson has recently been appointed Chief Engineer of the Packard Electric Co., St. Catharines. The Company are making extensive alterations in their works, not only with a view of increasing the output of their present lines of manufacture necessitated by the rapidly growing demand, but also to add other lines of apparatus which will in due course be offered to the trade. Mr. Parson graduated in Electrical Engineering at McGill in 1901 receiving the degree of B.Sc. and from 1901 to 1903 was demonstrator in the Department of Electrical Engineering under Professor Owens, and received the degree of M.Sc. for original research work. In the spring of 1903 he went to the Bullock Electrical Manufacturing Company at Cincinnati where he was associated with Mr. B. A. Behrend, chief engineer. In 1904 he was appointed Chief Electrical Engineer of the Allis-Chalmers-Bullock, at Montreal. In his capacity as Chief Engineer of the Packard Electric Company, it is safe to assume that, with the assistance of his staff of able and competent shop men, the present products of the Company will be brought up to the highest standard as will also the new lines of apparatus which the Company will shortly put upon the market.

The Continental Life Bldg., Toronto, is being equipped with a compound duplex pumping engine, manufactured by Smart-Turner Machine Co., Hamilton.

POWER HOUSES



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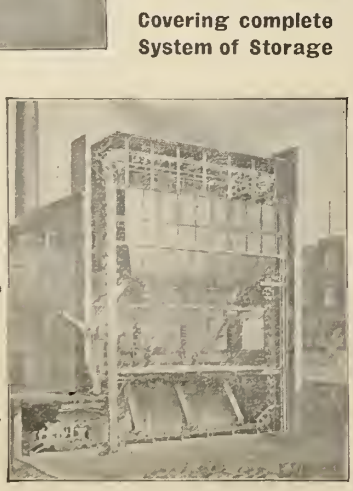

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Sent to subscribers to Canadian Machinery for $1.50 a year.

THE

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TORONTO

MILLING MACHINE ATTACHMENT.

(Continued from page 458.)

each movement of the crank. Mistakes would very likely occur. In order to obviate the necessity of thus counting the number of holes each time, there is supplied a device known as a sector or spacer, which consists of two hinged blades which swing about the center of the index plate, and that can be set to space off the required number of holes. This device together with the plate is shown in Fig. 4. The plate as will be seen has six circles of holes, all being spaced from an initial radial line as indicated by the arrow. The circles are numbered here according to the number of holes they contain.

The spacer is shown in position for spacing off five holes on the 18 hole circle. The blades are locked in position by the screw S, which bind the nave of one on that of the other when the index pin and crank have been shifted from the hole to the left to that at the right, the spacer is swung around to the position shown by the dotted lines, this is repeated at each indexing. The habit should be formed of doing this as soon as the crank has been turned and set in the proper position, and before going on with the milling as the liability of making mistakes is much lessened by this process.

Additional Light for Montreal.

For years the Montreal Light, Heat & Power Co., have held a monopoly of both electric and gas lighting for that city. A new offer was recently made to supply electric light by the Saraguay Electric Co., at a rate much lower than the citizens of Montreal are now paying. The offer made by this company included three clauses; first a direct offer of three-quarters of a cent per ampere hour, less 35 per cent bonus to the city on the total earnings; third, three-quarters of a cent per ampere hour, less 30 per cent discount, and to impose on the company the same conditions as those imposed on the Montreal Light, Heat & Power Co. The matter has been promised consideration by the mayor of Montreal, and it would look as though that city were to be favored with cheaper light than it has enjoyed for some time. The Saraguay Co., have obtained a twenty-five year light and power franchise for the village of Ahuntsic, and a pumping contract for the water works.

A Promising Industry.

The Canada Forge Co., of Welland, who were recently incorporated under the laws of Ontario with $100,000.00, are rapidly pushing their plant to completion and expect to be manufacturing in the course of a few weeks. It was decided to locate in Welland on account of various advantages. The plant was primarily established to take care of Canadian trade, and is the first plant in Canada modernly equipped for the manufacture of steel forgings exclusively. Every description of open hearth steel forgings from 10 to 10,000 lbs. in weight in rough or finished state, will be made by the company; who willi make, a specialty of crank shafts and connecting rods for marine and stationary engines. The machine shop will be run by electric power from Niagara, and will be

CONDENSED ADS.

RATES

One insertion—25c. for 20 words; 1c. a word for each additional word.

Yearly rate—$2.50 for twenty words or less, 10c a word for each additional word.

The above does not apply to notices under the head of "Machinery Wanted." These notices are inserted free for subscribers.

WESTERN REPRESENTATIVE WANTED.

AN agent in the west to handle Beardshaws' "Conqueror" high speed steel and drills, which are meeting with a favorable reception throughout Canada. Alex. Gibb, 13 St. John St., Montreal.

MACHINERY WANTED.

SMOKE consumers are not necessary with producer gas power, because the smoke is turned into gas and used for power; no matter what fuel you use there is absolutely no smoke; write for details or call. W. Gillespie, 98 Front Street, Toronto.

CORBET Foundry and Machine Company, Owen Sound, Ont., make a specialty of marine and stationary engines and boiler repairs; also all kinds of sheet steel work, such as stacks, flumes, hoppers, etc.; write for prices.

TURBINE Water Wheels—The following is another proof that the Canadian turbine is the most economical wheel made:—"Almonte, Ontario, with a pair of 42" Canadian turbines, is practically the only town in the Ottawa valley having an extensive electric plant that was able to run to its full capacity throughout this dry summer, with water to spare." Charles Barber & Sons, Meaford, Ontario.

WANTED—Second-hand gasoline engines; from two to four horse power. Krug Bros. & Co., Chesley.

WANTED — Immediately — Horizontal turbular boiler; six to eight horse power; cash price and minute description necessary. Box 8, Otterville.

FOR SALE

"LITTLE GIANT" turbine water wheels, machine-cut wood and iron tooth gearing; power transmission machinery orders executed with despatch; get catalogue and prices. J. C. Wilson & Co., Glenora, Ont.

SITUATIONS VACANT

WANTED—By new firm, traveler for engineers' supplies Good salary to experienced man with good connection. Full particulars from Baxter, Paterson & Co., care of CANADIAN MACHINERY, Montreal. [10]

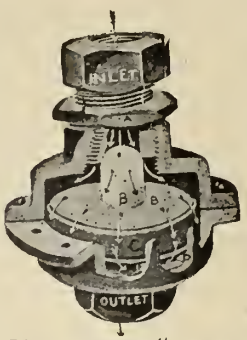
SITUATIONS VACANT.

HELP Wanted — Lathe, bench and planer hands wanted at once; steady work and good wages to competent men; address stating age, experience, married or single and wages expected. B. F. Barnes Company, Rockford, Ill.

FIRST-CLASS Machinery Moulder wanted; immediately. Manson Mfg. Co., Limited, Thorold.

FITTERS and Lathe Hands Wanted—Apply stating experience and wages expected, Box 396, Oshawa Ont.

WANTED—Sheet Metal Workers and press hands. Apply International Harvester Co. of Canada, Limited, Hamilton.



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Manufacturers of Reducing Valves and everything in Brass for Steam.

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SUBSCRIPTION CANVASSER WANTED.

Bright young man wanted to canvass for subscriptions to CANADIAN MACHINERY AND MANUFACTURING NEWS. One who has been connected with machine shop, or with some knowledge of mechanical subjects preferred. This offers good opportunity for advancement to the right man. Apply to

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equipped with the latest design of machinery to take care of forgings which are neeessarily of a heavy type. Raw material will be supplied from the plant of the Ontario Iron & Steel Co., in Welland. This company is closely affiliated with the Titusville Forge Co., Titusville, Pa., who have built up a large trade in this line of manufacture. The Canada Forge Co. are now ready to accept orders and expect to deliver goods by the latter part of the month of January, 1907.

Lumen Co.'s New Foundry

The Lumen Bearing Co. is about to move their Canadian foundry now located at 114 Jarvis St., Toronto, to a modern foundry equipped especially for their work at Toronto Junction, where they will have a capacity for 7,000 pounds per day of castings, and will have the necessary crane equipment, etc., for handling castings up to three thousand pounds. They will continue to make their well-known Lumen bronze as well as maganese bronze brass and aluminum castings. They expect to be completely installed the first of the new year.

The Best Rocky Mountain Pass

Engineers completing the surveys through the mountains from Edmonton for the Grand Trunk Pacific Railway, claim that no other pass is anything like as favorable as the Yellowhead, through which the Grand Trunk Pacific will run. The Yellowhead Pass is described as a park and the grade will in no place exceed one per cent. The heaviest grade from the eastern side is but 85-100 of one per cent, but in mountain railroading this is very low.

New Plant for Goderich

Engineer J. B. Kelly, Goderich, has recommended to the council the replacing of the present electric lighting apparatus with an entirely new one, involving the purchase of a new generator, switch-board, regulator for arc lights, shafting, and the construction of new foundations for boilers. Mr. Kelly has beeen asked by the council to go to Berlin, to investigate the merits of the producer gas engine, but should it be decided not to adopt this, then a new boiler, air-pump, condenser, etc., will have to be purchased to replace part of the present apparatus. The council will also seek the advice of Supt. McKenzie, of the Swift Co., New York City, who has had experience with the producer gas engine. After this year the water and light affairs of Goderich will probably be in the hands of a paid commission, the question is being voted on at New Years'.

New Mining Operations

Communication from Canadian Machinery's correspondent in the mining district of British Columbia, gives information of the Cariboo McKinney Mine, located at Camp McKinney, B.C., being opened up for active operations under a lease. Work has been commenced with a small force of men, which will be increased as the mine is placed in working order. The Cariboo McKinney is a quartz gold mine and is a stamp mill proposition. The equipment of the mine consists of a 10 drill compressor, a twenty stamp mill and a Scanide plant. Mr. George Cole, B.Sc., has accepted the position of assistant mining engineer of this mine, and under his direction it is anticipated there will be a boom in operation in that locality.

The Sight for G.T.P. Shops

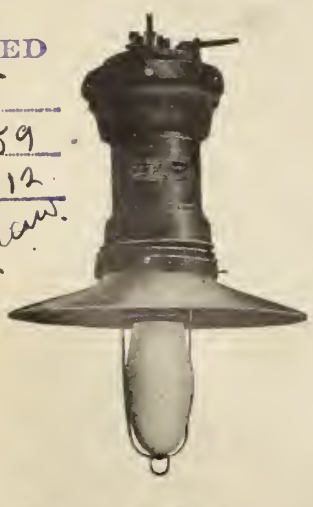
A site for the Winnipeg shops of the Grand Trunk Pacific Railway has been secured consisting of 300 acres, located in block F St. Boniface. Large and commodious shops will be built at this point, of modern design and equipped in a most up-to-date manner. The Canadian Northern and the Grand Trunk Pacific have decided to build a Union Depot at Winnipeg, which will be one of the finest terminal depots on the American continent.

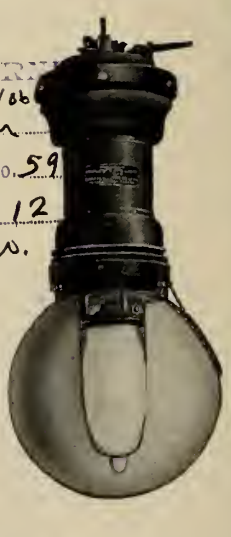
Another Industry for Berlin

The industrial committee and the town council of Berlin, Ont., are negotiating to have a large plant started in that city for the manufacture of agricultural machinery. The company propose investing $300,000.00 in the erection and equipment of this industry. A site comprising 10 acres of land has been selected in close proximity to the G.T.R. and C.P.R. It is purposed to employ 200 hands during the first year. No definite arrangements have as yet been concluded.

C. G. E. ARC LAMPS

FOR
INTERIOR AND EXTERIOR LIGHTING OF FACTORIES, WAREHOUSES, MILLS, Etc.





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Drills, Bench.

B. F. Barnes Co., Rockford, Ill.
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Drills, Blacksmith.

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Canadian Buffalo Forge Co., Montreal.
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Drills, Gang.

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Wm. Ahbott, Montreal.
American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.
Whitman & Barnes Co., St. Catharines.

Drills, Hand.

Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.

Drills, Horizontal.

B. F. Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Drills, Jewelers.

Pendrith Machinery Co., Toronto.

Drills, Pneumatic.

Canada Machinery Agency, Montreal.
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Drills, Radial.

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John Bertram & Sons Co., Dundas, Ont.
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Drills, Ratchet.

Armstrong Bros. Tool Co., Chicago.
A. B. Jardine & Co., Hespeler,
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Co., St. Catharines.

Drills, Rock.

Allis-Chalmers-Bullock, Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Drills, Sensitive.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Canada Machinery Agency Montreal.
Niles-Bement-Pond Co., New York

Drills, Shop View.

John Bertram & Sons Co., Dundas, Ont.

Drills, Twist.

Baxter, Paterson & Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Alex. Gibb, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
John Millen & Son, Ltd., Montreal.
Morse Twist Drill and Machine Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Co., St. Catharines,

Drying Apparatus of all Kinds.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt.
Sheldon's Limited, Galt
B. F. Sturtevant Co., Hyde Park, Mass

Dry Sand and Loam Facing.

Buffalo Foundry Supply Co., Buffalo.

Dump Cars.

Canada Foundry Co., Limited, Toronto
Dominion Henderson Bearings, Niagara Falls, Ont.
Hamilton Facing Mill Co., Hamilton.
Jenckes Machine Co., Sherbrooke, Que
Link-Belt Eng. Co., Philadelphia.
John McDougall Caledonian Iron Works Co., Montreal
Miller Bros. & Toms, Montreal.
Waterous Engine Co., Brantford.

Dust Separators.

Canadian Buffalo Forge Co. Montreal.
McEachren Heating and Ventilating Co., Galt.
Sheldon's Limited, Galt.

Dynamos.

Allis-Chalmers-Bullock, Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
D'Olier Engineering Co., New York.
Hall Engineering Works, Montreal, Que.
John Millen & Son, Ltd., Montreal.
Packard Electric Co., St. Catharines.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Man.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Dynamos—Turbine Driven.

Kerr-Turbine Co., Wellsville, N.Y.

Economizer, Fuel.

Canadian Buffalo Forge Co., Montreal.
Dominion Henderson Bearings, Niagara Falls, Ont.
McEachren Heating and Ventilating Co., Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Man.

Electrical Instruments.

Canadian Westinghouse Co., Hamilton.

Electrical Steel.

Baxter, Paterson & Co., Montreal.

Electrical Supplies.

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
London Mach. Tool Co., Hamilton, Ont.
John Millen & Son. Ltd., Montreal.
Packard Electric Co., St. Catharines.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Electrically Driven Tools and Machinery.

American Tool Works Co., Cincinnati.
Baxter, Paterson & Co., Montreal.

Canada Machinery Agency, Montreal.
Canadian Westinghouse Co., Hamilton.
Hall Engineering Works, Montreal, Que.
London Mach. Tool Co., Hamilton.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Electrical Repairs

Canadian Westinghouse Co., Hamilton.
T. & H. Electric Co., Hamilton.
Volta Electric Repair Works, Toronto.

Emery and Emery Wheels.

Baxter, Paterson & Co., Montreal.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Emery Wheel Dressers.

Baxter Paterson & Co., Montreal.
Canada Machinery Agency, Montreal.
Diamond Saw & Stamping Works, Buffalo
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.
John Millen & Son, Ltd., Montreal.
H. W. Petrie, Toronto.
Standard Tool Co., Cleveland.

Emery Wheel Dressers, Cutters.

Diamond Saw & Stamping Works, Buffalo.

Engineers and Contractors.

Canada Foundry Co., Limited, Toronto.
Canadian White Co. Montreal.
D'Olier Engineering Co., New York.
Hall Engineering Works, Montreal
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Link-Belt Co., Philadelphia.
John McDougall Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms Montreal.
Robb Engineering Co., Amherst, N.S.
The Smart-Turner Mach. Co., Hamilton.

Engineers' Supplies.

Baxter, Paterson & Co., Montreal.
Hall Engineering Works, Montreal.
Rice Lewis & Son, Toronto.

Engines, Gas and Gasoline.

Baxter, Paterson & Co., Montreal.
Canada Machinery Agency Montreal.
The Canadian Fairbanks Co., Montreal.
Canadiao McVicker Engine Co., Galt.
Dominion Henderson Bearings, Niagara Falls, Ont.
Economic Heat, Light and Power Supply Co, Toronto.
W. Gillespie, Toronto.
The Goldie & McCulloch Co., Galt, Ont.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.

Engines, Steam.

Allis-Chalmers-Bullock, Montreal
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
D'Olier Engineering Co., New York.
The Goldie & McCulloch Co., Galt, Ont.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
John McDougall Caledonian Iron Works Montreal.
Miller Bros. & Toms, Montreal.
Robb Engineering Co., Amherst, N.S.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.
Waterous Engine Works Co., Brantford.

Engravers.

Toronto Engraving Co., Toronto.

Exhaust Heads.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Expanded Metal.

Expanded Metal and Fireproofing Co. Toronto

Expanders.

A. B. Jardine & Co., Hespeler, Ont.

Fans, Electric.

Canadian Buffalo Forge Co., Montreal.
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited Galt, Ont.
The Smart-Turner Mach. Co., Hamilton.
B. F. Sturtevant Co., Hyde Park, Mass.

Fans, Exhaust.

Canadian Buffalo Forge Co., Montreal.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.
McEachren Heating and Ventilating Co., Galt.
Sheldon's Limited, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Feed Water Heaters.

John McDougall, Caledonian Iron Works Co., Montreal.
The Smart-Turner Mach. Co., Hamilton

Files and Rasps.

Baxter, Paterson & Co., Montreal.
John Millen & Son Ltd., Montreal.
Rice Lewis & Son, Toronto.
Nicholson File Co., Providence, R.I.
H. W. Petrie, Toronto.
Whitman & Barnes Co., St. Catharines.

Fillet, Pattern.

Baxter, Paterson & Co., Montreal.
Buffalo Foundry Supply Co., Buffalo.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Fire, Apparatus.

Waterous Engine Works Co., Brantford.

Fire Brick and Clay.

Baxter Paterson & Co., Montreal
Buffalo Foundry Supply Co., Buffalo.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.
J. W. Paxson Co., Philadelphia.

Flash Lights.

Berlin Electrical Mfg. Co., Toronto.

Flour Mill Machinery.

Allis-Chalmers-Bullock, Montreal.
The Goldie & McCulloch Co., Galt, Ont.
John McDougall, Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms, Montreal.

Flue Rollers.

Chicago Pneumatic Tool Co., Chicago.

Forges.

Canada Foundry Co., Limited, Toronto
Canadian Buffalo Forge Co., Montreal.
Hamilton Facing Mill Co., Hamilton.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Forgings, Drop.

John McDougall, Caledonian Iron Works Co. Montreal.
H. W. Petrie, Toronto.
St. Lawrence Supply Co., Montreal.
Whitman & Barnes Co., St. Catharines

Forging Machinery.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, Ohio
Niles-Bement-Pond Co., New York.

Founders.

John McDougall, Caledonian Iron Works Co., Montreal
R. McDougall Co., Galt, Ont.
Niagara Falls Machine & Foundry Co., Niagara Falls Ont.
The Smart-Turner Mach. Co., Hamilton.

Foundry Equipment.

Hanna Engineering Works Chicago.

Foundry Facings.

Buffalo Foundry Supply Co., Buffalo.
J. W. Paxson Co., Philadelphia, Pa.

Friction Clutch Pulleys, etc.

The Dodge Mfg. Co., Toronto.
The Goldie & McCulloch Co., Galt.
Link-Belt Co., Philadelphia.
W. B. McLean & Co., Montreal.
Miller Bros. & Toms, Montreal.
Sylvester Mfg. Co., Lindsay, Ont.

Furnaces.

Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Galvanizing

Canada Metal Co., Toronto.

Gas Blowers and Exhausters.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
D'Olier Engineering Co., New York.
B. F. Sturtevant Co., Hyde Park, Man.

Gas Plants, Suction.

Baxter Paterson & Co., Montreal
Dominion Henderson Bearings, Niagara Falls, Ont.
Economic Heat, Light and Power Supply Co., Toronto.
W. Gillespie, Toronto.

Gauges, Standard.

Brown & Sharpe, Providence, R.I.
W. B. McLean & Co. Montreal.
Pratt & Whitney Co., Hartford, Conn.

Gearing.

W. B. McLean & Co., Montreal.

Gear, Cutting Machinery.

Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cincinnati.
Brown & Sharpe, Providence, R. I.
London Mach. Tool Co., Hamilton.
R. McDougall Co., Galt.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford. Conn.
Williams & Wilson, Montreal.

Gears, Angle.

Brown & Sharpe, Providence, R.I.
Chicago Pneumatic Tool Co., Chicago.
Laurie Engine & Machine Co., Montreal.
John McDougall, Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms, Montreal.
Waterous Engine Co., Brantford.

Gears, Reducing.

Brown & Sharpe, Providence, R.I.
Chicago Pneumatic Tool Co., Chicago.
John McDougall, Caledonian Iron Works Co., Montreal
Miller Bros. & Toms, Montreal.

Generators, Electric.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton.
D'Olier Engineering Co., New York.
Hall Engineering Works, Montreal.
H. W. Petrie, Toronto.
B. F. Sturtevant Co., Hyde Park, Mass.

Generators, Gas.

H. W. Petrie, Toronto.

Glass Bevelling Machines.

Pendrith Machinery Co., Toronto.

Graphite Paints.

P. D. Dods & Co., Montreal.

Graphite.

Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Grinders, Automatic Knife.

W. H. Banfield & Son, Toronto.

Grinders, Centre.

Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinders, Cutter.

Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Millen & Son, Ltd., Montreal.
Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.

Grinders, Tool.

Armstrong Bros. Tool Co., Chicago.
B. F. Barnes Co., Rockford, Ill.
Brown & Sharpe, Providence, R.I.
H. W. Petrie, Toronto.
The Stevens Co., Galt, Ont.
Williams & Wilson, Montreal.

Grinding Machines.

Brown & Sharpe, Providence, R.I.
The Canadian Fairbanks, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.

Grinding and Polishing Machines.

The Canadian Fairbanks Co., Montreal.
Dominion Henderson Bearings, Niagara Falls, Ont.
John Millen & Son, Ltd., Montreal.
Miller Bros. & Toms, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pendrith Machinery Co., Torouto.

Hack Saws.

Baxter, Paterson & Co., Montreal.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Diamond Saw and Stamping Works, Buffalo, N. Y.
John Millen & Son, Ltd., Montreal.
Niles-Bement-Pond Co., New York.
W. B. McLean & Co., Montreal.
H. W. Petrie, Toronto.
West Haven Mfg. Co., New Haven, Conn.
Williams & Wilson, Montreal.

Hack Saw Frames

Baxter, Paterson & Co., Montreal
Diamond Saw and Stamping Works, Buffalo, N.Y.
West Haven Mfg Co, New Haven, Conn.

Hammers, Drop.

London Mach. Tool Co., Hamilton, Ont.
Miller Bros. & Toms Montreal
Niles-Bement-Pond Co., New York.

Hammers, Rand—All Kinds.

Whitman & Barnes Co., St Catharines.

Hammers, Steam.

John Bertram & Sons Co. Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York

Hangers.

Dominion Henderson Bearings, Niagara Falls, Ont.
The Goldie & McCulloch Co., Galt
Miller Bros. & Toms, Montreal
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford.
Pendrith Machinery Co., Toronto.

Hardware Specialties

Globe Machin & Stamping Co., Cleveland Ohio.

Heating Apparatus.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt.
B. F. Sturtevant Co., High Park, Mass.

Hoisting and Conveying Machinery.

Allis-Chalmers-Bullock, Limited, Montreal
Jenckes Machine Co., Sherbrooke, Que.
Link-Belt Co., Philadelphia.
Miller Bros. & Toms, Montreal.
Niles-Bement-Pond Co., New York.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford,

Hoists, Pneumatic.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co. Chicago.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Hose.

Baxter, Paterson & Co., Montreal.

Hose, Air.

Canadian Rand Drill Co., Montreal.
Canadian Westinghouse Co., Hamilton.
Chicago Pneumatic Tool Co. Chicago.

Hose Couplings.

Canadian Rand Drill Co., Montreal.
Canadian Westinghouse Co., Hamilton.
Chicago Pneumatic Tool Co., Chicago.
Whitman & Barnes Co., St. Catharines.

Hose, Steam.

Allis-Chalmers-Bullock, Montreal.
Canadian Rand Drill Co., Montreal.
Canadian Westinghouse Co., Hamilton.

Hydraulic Accumulators.

Niles-Bement-Pond Co., New York.
The Smart-Turner Mach. Co., Hamilton.

Hydraulic Machinery.

Allis-Chalmers-Bullock, Montreal
John McDougall, Caledonian Iron Works Co., Montreal.
Niles-Bement-Pond Co., New York.

Indicators, Speed.

L. S. Starrett Co., Athol, Mass.

Injectors.

Canada Foundry Co., Toronto.
The Canadian Fairbanks Co., Montreal.
Rice Lewis & Son, Toronto.
Penberthy Injector Co., Windsor, Ont.

Iron Cements.

Buffalo Foundry Supply Co., Buffalo.
Hamilton Facing Mill Co., Hamilton.

Iron Filler.

Buffalo Foundry Supply Co., Buffalo.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Iron Tools.

John Bertram & Sons Co., Dundas, Ont.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton.
R. McDougall Co., Galt.
H. W. Petrie, Toronto.
The Stevens Co., Galt.

Key-Seating Machines.

B. F. Barnes Co., Rockford, Ill.
Niles-Bement-Pond Co., New York.

Lace Leather.

Baxter, Paterson & Co., Montreal.
Sadler & Haworth, Montreal.

Lamps, Arc and Incandescent.

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
The Packard Electric Co., St. Catharines.

Lathe Dogs.

Armstrong Bros., Chicago
Baxter, Paterson & Co., Montreal.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Engine.

American Tool Work Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.
Baxter, Paterson & Co., Montreal
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
R. McDougall Co., Galt, Ont.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.

Lathes, Foot-Power.

American Tool Works Co., Cincinnati.
B. F. Barnes Co., Rockford, Ill.

Lathes, Screw Cutting.

B. F. Barnes Co., Rockford, Ill.
Baxter, Paterson & Co., Montreal.
Niles-Bement-Pond Co., New York.

Lathes, Automatic, Screw-Threading.

John Bertram & Sons Co., Dundas, Ont
London Mach. Tool Co., Hamilton, Ont
Pratt & Whitney Co., Hartford, Conn.

Lathes, Bench.

B. F. Barnes Co., Rockford, Ill.
London Mach. Tool Co., London, Ont.
Pratt & Whitney Co., Hartford, Conn

Lathes, Turret.

American Tool Works Co., Cincinnati.
Baxter, Paterson & Co., Montreal.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
R. McDougall Co., Galt, Ont.
The Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.
Warner & Swasey Co., Cleveland O.

Lathes, Buffing and Polishing.

Pendrith Machinery Co., Toronto.

Lathes, Metal Spinning.

Pendrith Machinery Co., Toronto.

Leather Belting.

Baxter, Paterson & Co., Montreal.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal
The Dodge Mfg. Co., Toronto.

Lime Stone Flux.

Hamilton Facing Mill Co., Hamilton.

Locomotives, Air.

Canadian Rand Drill Co., Montreal.

Locomotives, Electrical.

Canadian Westinghouse Co., Hamilton

Locomotives, Steam.

Canada Foundry Co., Toronto.
Canadian Rand Drill Co., Montreal

Lubricator, Plumbago.

Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Lumber Dry Kilns.

Canadian Buffalo Forge Co., Montreal
McEachren Heating and Ventilating Co., Galt, Ont.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevaut Co., Hyde Park, Mass.

Machinery Dealers.

Baxter, Paterson & Co., Montreal.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Dominion Henderson Bearings, Limited, Toronto.
Miller Bros. & Toms, Montreal.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
St. Lawrence Supply Co., Montreal.
Williams & Wilson Montreal.

Machinery Designers.

Dominion Henderson Bearings, Niagara Falls, Ont.

Machinists.

W. H. Banfield & Sons, Toronto.
The Dodge Mfg. Co., Toronto.
Dominion Henderson Bearings, Niagara Falls, Ont.
Hall Engineering Works Montreal.
Link-Belt Co., Philadelphia.
John McDougall, Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms Montreal.
Pendrith Machinery Co., Toronto.
Robb Engineering Co., Amherst, N.S.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford.

Machinists' Small Tools.

Armstrong Bros., Chicago.
Brown & Sharpe, Providence, R.I.
Butterfield & Co., Rock Island, Que.
Diamond Saw and Stamping Works, Buffalo, N. Y.
Rice Lewis & Son, Montreal.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
L. S. Starrett Co., Athol, Mass.
Williams & Wilson, Montreal.
Whiteman & Barnes Co., St. Catharines.

Mailing Weights.

A. B. Jardine & Co., Hespeler, Ont.

Mallet, Rawhide and Wood.

Buffalo Foundry Supply Co., Buffalo.

Mandrels.

Brown & Sharpe, Providence, R.I.
A. B. Jardine & Co., Hespeler, Ont.
Miller Bros & Toms, Montreal
The Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Co., St. Catharines

Measuring Machines.

The Pratt & Whitney Co., Hartford, Conn.

Mechanical Draft.

Canadian Buffalo Forge Co., Montreal.
H. W. Petrie, Toronto.
Sheldon's Limited, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Metallic Paints.

P. D. Dods & Co., Montreal.

Meters, Electrical.

Canadian Westinghouse Co., Hamilton.

Mill Machinery.

Baxter, Paterson & Co., Montreal.
The Dodge Mfg. Co., Toronto.
The Goldie & McCulloch Co., Galt, Ont.
Jenckes Machine Co., Sherbrooke, Que.
John McDougall, Caledonian Iron Works Co., Montreal.
H. W. Petrie, Toronto.
Robb Engineering Co., Amherst, N.S.
Waterous Engine Co., Brantford.
Williams & Wilson, Montreal.

Milling Attachments.

Becker-Brainard Milling Machine Co. Hyde Park, Mass.
John Bertram & Sons Co., Dundas, Ont.
Brown & Sharpe, Providence, R.I.
Niles-Bement-Pond Co., New York,
Pratt & Whitney, Hartford, Conn.
The Stevens Co., Galt, Ont.

Milling Machines, Horizontal.

Baxter, Paterson & Co., Montreal.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
John Bertram & Sons Co., Dundas, Ont.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
Pratt & Whitney, Hartford, Conn.

Milling Machines, Plain.

American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co. Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Milling Machines, Universal.

American Tool Works Co., Cincinnati.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Williams & Wilson, Montreal.

Milling Machines, Vertical.

Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Milling Tools.

Wm. Abbott, Montreal.
Becker-Brainard Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe, Providence, R.I.
Dominion Henderson Bearings, Niagara Falls Ont.
Geometric Tool Co., New Haven, Conn.
London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
The Stevens Co., Galt, Ont.

Mining Machinery.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
The Dodge Mfg. Co., Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
John McDougall, Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms, Montreal.
T. & H. Electric Co. Hamilton.

Mixing Machines, Dough.

Pendrith Machinery Co., Toronto.

Mixing Machines, Special.

Pendrith Machinery Co., Toronto.

Model Tools.

Dominion Henderson Bearings, Niagara Falls Ont
Globe Machine & Stamping Co., Cleveland, Ohio.
The Stevens Co., Galt, Ont.
Wells Pattern and Model Works, Toronto

Motors, Electric.

Allis-Chalmers-Bullock Limited, Montreal
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Hall Engineering Works, Montreal.
The Packard Electric Co., St. Catharines.
B. F. Sturtevant Co., Hyde Park, Mass.
T. & H. Electric Co., Hamilton.

Motors, Air.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.

Molders' Supplies.

Buffalo Foundry Supply Co., Buffalo.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton

Molders' Tools.

Buffalo Foundry Supply Co., Buffalo.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Molding Machines.

Buffalo Foundry Supply Co., Buffalo.
J. W. Paxson Co., Philadelphia, Pa.

Molding Sand.

T. W. Barnes, Hamilton
Buffalo Foundry Supply Co., Buffalo.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Nippers, Stay Bolt.

Chicago Pneumatic Tool Co., Chicago.

Nut Tappers.

John Bertram & Sons Co., Dundas, Ont
A. B. Jardine & Co., Hespeler.
London Mach. Tool Co., Hamilton.
National Machinery Co., Tiffin, Ohio.

Oatmeal Mill Machinery.

The Goldie & McCulloch Co., Galt

Oils, Core.

Buffalo Foundry Supply Co. Buffalo.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Painting Machines, Pneumatic.

Chicago Pneumatic Tool Co., Chicago.

Patent Solicitors.

Hanbury A. Budden, Montreal.
Fetherstonhough & Blackmore, Montreal
Fetherstonhaugh & Co., Montreal.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.

Patterns.

John Carr, Hamilton.
The Dodge Mfg. Co., Toronto.
Hamilton Pattern Works, Hamilton.
John McDougall, Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms Montreal.
The Stevens Co., Galt, Ont.
Wells' Pattern and Model Works, Toronto.

Pipe Cutting and Threading Machines.

Butterfield & Co., Rock Island, Que.
Canada Machinery Agency, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York.

Pipe, Municipal.

Pacific Coast Pipe Co., Vancouver, B.C.

Pipe, Waterworks.

Pacific Coast Pipe Co., Vancouver, B.C

Pipe, Wooden.

Pacific Coast Pipe Co., Vancouver, B.C.

Planers, Standard.

American Tool Works, Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Planers, Rotary.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Power Hack Saw Machines.

Baxter, Paterson & Co., Montreal.
Diamond Saw and Stamping Works, Buffalo, N. Y.

Power Plants.

John McDouzall Caledonian Iron Works Co., Montreal
The Smart-Turner Mach. Co., Hamilton

Planing Mill Fans.

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Man.

Plug Drillers, Pneumatic.

Canada Foundry Co., Limited, Toronto.
Canadian Rand Drill Co., Montreal.

Plumbago.

Buffalo Foundry Supply Co., Buffalo.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton,
J. W. Paxson Co., Philadelphia, Pa.

Pneumatic Tools.

Allis-Chalmers-Bullock, Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago
Hamilton Facing Mill Co., Hamilton.
Hanna Engineering Works, Chicago.

Presses, Drill.

American Tool Works Co., Cincinnati.
Niles-Bement-Pond Co., New York.

Presses, Drop.

W. H. Banfield & Son, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Canada Machinery Agency, Montreal.
Miller Bros. & Toms, Montreal.
Niles-Bement-Pond Co., New York

Presses, Hand.

E. W. Bliss Co., Brooklyn, N.Y.

Presses, Hydraulic.

Jenckes Machine Co., Sherbrooke, Que.
John Bertram & Sons Co., Dundas, Ont.
Laurie Engine & Machine Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
John McDougall Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms, Montreal.
Niles-Bement-Pond Co., New York.

Presses, Power.

E. W. Bliss Co., Brooklyn, N.Y.
Canada Machinery Agency, Montreal.
Jenckes Machine Co., Sherbrooke, Que.
London Mach Tool Co., Hamilton, Ont.
John McDougall Caledonian Iron Works Co., Montreal.
Niles-Bement-Pond Co., New York.

Pulp Mill Machinery.

Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
John McDougall Caledonian Iron Works Co., Montreal.

Pulleys.

Baxter, Paterson & Co., Montreal.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
The Dodge Mfg. Co., Toronto.
Dominion Henderson Bearings, Niagara Falls, Ont.
The Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Laurie Engine & Machine Co., Montreal.
Link-Belt Co., Philadelphia
John McDougall Caledonian Iron Works Co., Montreal.
Miller Bros. & Toms, Montreal.
Pendrith Machinery Co., Toronto.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Williams & Wilson, Montreal.
Waterous Engine Co., Brantford.

Pumps, Steam.

Allis-Chalmers-Bullock, Limited, Montreal
Canada Foundry Co., Toronto.
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
D'Olier Engineering Co., New York.
Dominion Henderson Bearings, Niagara Falls, Ont
The Goldie & McCulloch Co., Galt.
John McDougall Caledonian Iron Works, Montreal.
R. McDougall Co., Galt, Ont.
H. W. Petrie, Toronto.
St. Lawrence Supply Co., Montreal.
The Smart-Turner Mach. Co., Hamilton.
Sylvester Mfg. Co., Lindsay, Ont.
Waterous Engine Co., Brantford

Pumping Machinery.

Canada Foundry Co., Limited Toronto
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
D'Olier Engineering Co., New York.
Dominion Henderson Bearings, Niagara Falls, Ont
Hall Engineering Works, Montreal, Que.
Laurie Engine & Machine Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
John McDougall Caledonian Iron Works Co., Montreal.
R. McDougall Co., Galt, Ont.
St. Lawrence Supply Co., Montreal.
The Smart-Turner Mach. Co., Hamilton.

Punches and Dies.

W. H. Banfield & Sons, Toronto.
Butterfield & Co., Rock Island.
Dominion Henderson Bearings, Niagara Falls, Ont
Globe Machine & Stamping Co.
A. B. Jardine & Co., Hespeler, Ont.
London Mach. Tool Co., Hamilton, Ont.
Miller Bros & Toms, Montreal.
Pratt & Whitney Co., Hartford, Conn.
H. W. Petrie, Toronto.

Punches, Hand.

Canadian Buffalo Forge Co., Montreal

Punches, Power.

John Bertram & Sons Co., Dundas, Oot.
E. W. Bliss Co., Brooklyn, N.Y.
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Punches, Turret.

London Mach. Tool Co., London, Ont.
Taylor & McKenzie, Guelph.

Punching Machines, Horizontal.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton Ont.
Niles-Bement-Pond Co., New York.

Quartering Machines.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.

Rammers, Bench and Floor.

Buffalo Foundry Supply Co., Buffslo.

Rapping Plates.

Hamilton Facing Mill Co., Hamilton.

Reamers.

Wm. Abbott, Montreal.
Baxter, Paterson & Co., Montreal.
Brown & Sharpe, Providence, R.I.
Butterfield & Co., Rock Island.
Hanna Engineering Works Chicago.
A. B. Jardine & Co., Hespeler, Ont.
John Millen & Son, Ltd., Montreal.
Morse Twist Drill and Machine Co., New Bedford, Mass
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
The Stevens Co., Galt, Ont.
Whitman & Barnes Co., St. Catharines.

Reamers, Steel Taper.

Butterfield & Co., Rock Island.
Chicago Pneumatic Tool Co., Chicago.
A. B. Jardiue & Co., Hespeler, Ont.
John Millen & Son Ltd., Montreal.
Pratt & Whitney Co., Harttord, Conn.
Standard Tool Co., Cleveland.
Whitman & Barnes Co., St. Catharines.

Rheostats.

Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Hall Engineering Works, Montreal, Que.
T. & B. Electric Co., Hamilton,

Riddles.

Buffalo Foundry Supply Co,, Buffalo.
J. W. Paxson Co., Philadelphia, Pa.

Riveters, Hydraulic.

London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Riveters, Pneumatic.

Hanna Engineering Works, Chicago.

Rolls, Bending.

John Bertram & Sons Co., Dundas, Ont.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Rotary Converters.

Allis-Chalmers-Bullock, Ltd., Montreal.
Canadiau Westinghouse Co., Hamilton

Safes.

Baxter, Paterson & Co., Montreal.
The Goldie & McCulloch Co., Galt, Ont.

Sand, Bench.

Buffalo Foundry Supply Co., Buffalo.

Sand Blast Machinery.

Canadian Rand Drill Co., Montreal.
Chicago Pneumatic Tool Co., Chicago.
Hamilton Facing Mill Co., Hamilton.
J. W. Paxson Co., Philadelphia, Pa.

Sand, Brass.

Buffalo Foundry Supp'y Co., Buffalo.

Sand, Heavy, Grey Iron.

Buffalo Foundry Supply Co., Buffalo.

Sand, Malleable.

Buffalo Foundry Supply Co , Buffalo,

Sand, Medium Grey Iron.

Buffalo Foundry Supply Co., Buffalo.

Sand, Plate.

Buffalo Foundry Supply Co., Buffalo.

Sand Sifters.

Buffalo Foundry Supply Co., Buffalo.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.
Hanna Engineering Works, Chicago.

Sand, Stove Pipe.

Buffalo Foundry Supply Co., Buffalo.

Saw Gummers.

Canada Machinery Agency, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Waterous Engine Co., Brantford.

Saw Machines, Power Hack.

Baxter Paterson & Co., Mootreal
Diamond Saw & Stamping Works, Buffalo.
West Haven Mfg. Co., New Haven, Conn.

Saw Mill Machinery.

Allis-Chalmers-Bullock, Limited, Montreal
Baxter, Paterson & Co., Montreal.
Canada Machiuery Agency. Montreal.
Clark-Demill Co., Hespeler, Ont.
The Dodge Mfg. Co., Toronto.
Dominion Henderson Bearings, Niagara Falls, Ont.
Goldie & McCulloch Co., Galt.
Miller Bros. & Toms, Montreal.
H. W. Petrie, Toronto.
Robb Engineering Co., Amherst, N.S.
Waterous Engine Works, Brantford.
Williams & Wilson, Montreal.

Sawing Machines, Metal.

Niles-Bement-Pond Co. New York.
West Haven Mfg. Co., New Haven, Conn.

Saws, Hack.

Baxter Paterson & Co., Montreal.
Canada Machinery Agency. Montreal.
Diamond Saw & Stamping Works, Buffalo.
London Mach. Tool Co., Hamilton
Rice Lewis & Son, Toronto.
John Millen & Son, Ltd., Montreal.
L. S. Starrett Co., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn

Saws, Kitchen.

Diamond Saw & Stamping Works, Buffalo

Saws, Power Hack.

Diamond Saw & Stamping Works, Buffalo.
West Haven Mfg. Co., New Haven, Conn.

Screw Cutting Tools

Hart Manufacturing Co., Cleveland, Ohio

Screw Machines, Automatic.

Brown & Sharpe, Providence, R.I.
Canada Machinery Agency, Montreal.
London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.

Screw Machines, Hand.

Brown & Sharpe, Providence, R.I.
Canada Machinery Agency Montreal.
A. B. Jardine & Co., Hespeler.
London Mach. Tool Co., Hamilton, Ont.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, O.

Screw Plates.

Butterfield & Co., Rock Island, Que.
Hart Manufacturing Co., Clevelaud, Ohio
A. B. Jardine & Co., Hespeler.

Second-Hand Machinery.

American Tool Works Co., Cincinnati.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Goldie & McCulloch Co., Galt.
Machinery Exchange, Montreal.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Robb Engineering Co., Amherst, N.S.
Waterous Engine Co., Brantford.
Williams & Wilson, Montreal.

Shafting.

Baxter, Paterson & Co., Montreal.
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
The Dodge Mfg. Co., Toronto.
The Goldie & McCulloch Co., Galt, Ont
Jenckes Machine Co., Sherbrooke, Que.
Niles-Bement-Pond Co., New York.
Pendrith Machine Co., Toronto.
H. W. Petrie, Toronto.
Smart-Turner Machine Co., Hamilton.
Union Drawn Steel Co., Hamilton.
Waterous Engine Co., Brantford.

Shapers.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
Williams & Wilson, Montreal.

Shearing Machine, Bar.

John Bertram & Sons Co., Dundas, Oot.
Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Shears, Bench.

Canadian Buffalo Forge Co., Montreal.

Shears, Continuous.

Canadian Buffalo Forge Co., Montreal.

Shears, Hand.

CanadianBuffalo Forge Co., Montreal.

Shears, Power.

John Bertram & Sons Co., Dundas, Ont.
Canada Macbinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.

Sheet Metal Goods

Globe Machine & Stamping Co., Cleveland, Ohio.

Shovels.

Baxter, Paterson & Co., Montreal.
Buffalo Foundry Supply Co., Buffalo.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Shovels, Steam.

Allis-Chalmers-Bullock, Montreal.

Sieves.

Buffalo Foundry Supply Co., Buffalo.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Silver Lead.

Buffalo Foundry Supply Co., Buffalo.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Sleeves, Reducing.

Chicago Pneumatic Tool Co., Chicago.

Slide Rests.

Niles-Bement-Pond Co., New York.

Smoke Connections.

Jenckes Machine Co., Sherbrooke, Que

Smoke Stacks.

Jenckes Machine Co., Sherbrooke, Que.

Snap Flasks

Buffalo Foundry Supply Co., Buffalo.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Soapstone.

Buffalo Foundry Supply Co., Buffalo.
Dominiou Foundry Supply Co., Mootreal

Special Machinery.

W. H. Banfield & Sons, Toronto.
Baxter Paterson & Co., Montreal
John Bertram & Sons Co., Dundas, Ont.
Dominion Henderson Bearings, Niagara Falls, Ont
Globe Machine & Stamping Co., Cleveland Ohio.
Hanna Engineering Works, Chicago.
Laurie Engine & Machine Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
R. McDougall Co., Galt, Ont.
Pendrith Machinery Co., Toronto.
H. W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton
The Stevens Co., Galt.
Waterous Engine Co., Brantford.

Special Machines and Tools.

Dominion Henderson Bearings, Niagara Falls Ont
Pratt & Whitney, Hartford, Conn.
The Stevens Co., Galt, Ont.

Special Manufacturing.

Dominion Henderson Bearings, Niagara Falls, Ont.
Globe Machine & Stamping Co., Cleveland.
Miller Bros. & Toms. Montreal.
Pendrith Machine Co., Toronto.
The Stevens Co., Galt, Ont.

Special Repairs.

Dominion Henderson Bearings, Niagara Falls, Ont.

Speed Changing Countershafts.

The Canadian Fairbanks Co., Montreal
The Dodge Mfg. Co., Toronto.

Spike Machines.

National Machinery Co., Tiffin, O.
The Smart-Turner Mach. Co., Hamilton.

Spray Cans.

Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Sprue Cutters.

Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Stamp Mills.

Allis-Chalmers-Bullock, Limited, Montreal

Stampings, Sheet Metal.

Baxter, Paterson & Co., Montreal.

Steam Hot Blast Apparatus

Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt.
Sheldon's Limited, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Steam Plants.

Jenckes Machine Co., Sherbrooke, Que.

Steam Separators.

McEachren Heating and Veotilating Co., Galt.
Robb Engineering Co., Montreal.
Sheldon's Limited, Galt.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford.

Steam Specialties.

Engineering Specialties Co., Belfast, Ireland.
McEachren Heating and Ventilating Co., Galt.
Sheldon's Limited, Galt.

Steam Traps.

Canada Machiuery Agency, Montreal.
Engineering Specialties Co., Belfast, Ireland.
McEachren Heatiog and Veotilating Co., Galt.
Pendrith Machinery Co., Toronto.
Sheldon's Limited, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Steel Pressure Blowers

Buffalo Foundry Supply Co,, Buffalo.
Canada Machinery Agency, Montreal.
Canadian Buffalo Forge Co., Montreal.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.
McEachren Heating and Ventilating Co., Galt.
J. W. Paxon Co., Philadalphia, Pa.
Sheldon's Limited, Galt.
B. F. Sturtevant Co., Hyde Park, Mass.

Steel Tubes.

Baxter, Paterson & Co., Montreal.
John Millen & Son, Montreal.

Steel, High Speed.

Wm. Abbott, Montreal.
Canadian Fairbanks Co., Montreal.
Alex. Gibb, Montreal.
Jessop, Wm., & Sons, Sheffield, Eng.
B. K. Morton Co., Sheffield, Eng.
Williams & Wilson, Montreal.

Stocks and Dies

Hart Manufacturing Co., Cleveland, Ohio
Pratt & Whitney Co., Hartford, Conu.

Stone Cutting Tools, Pneumatic

Allis-Chalmers-Bullock, Ltd , Montreal
Canadian Rand Drill Co , Montreal.
St. Lawrence Supply Co., Montreal.

Stone Surfacers

Chicago Pneumatic Tool Co., Cbicago.

Stove Plate Facings.

Dominion Foundry Supply Co., Montreal
Hamiltou Faciug Mill Co., Hamilton.

Swage, Block.

A. B. Jardine & Co., Hespeler, Oot.
Ottawa Steel Castings Co., Ottawa,

Switchboards.

Allis-Chalmers-Bullock, Limited, Montreal
Canadian General Electric Co., Toronto
Canadian Westinghouse Co., Hamilton
Hall Engineering Works, Montreal, Que.
Volta Electrical Repair Works, Toronto.

Talc.

Buffalo Foundry Supply Co., Buffalo.

Tapping Machines and Attachments.

American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
Bickford Drill & Tool Co., Cincinnati.
Canada Machinery Agency Montreal.
The Geometric Tool Co., New Haven,
A. B. Jardine & Co., Hespeler.
London Mach. Tool Co., Hamilton, Ont
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney, Cincinnati, O.
L. S. Starrett Co., Athol, Mass.
Williams & Wilson, Montreal.

Tapes, Steel.

Rice Lewis & Son, Toronto.
John Millen & Son, Ltd , Montreal.
L. S. Starrett Co., Athol, Mass.

Taps.

Baxter, Paterson & Co., Montreal.
Whitman & Barnes Co., St. Catharines.

Taps, Collapsing.

The Geometric Tool Co., New Haven.

Taps and Dies.

Wm. Abbott, Montreal.
Baxter, Paterson & Co., Montreal.
Butterfield & Co., Rock Island, Que.
The Geometric Tool Co., New Haven.
A. B. Jardine & Co., Hespeler, Ont.
Rice Lewis & Son, Toronto.
John Millen & Son, Ltd , Montreal.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland.
L. S. Starrett Co., Athol, Mass.

Testing Laboratory.

Det oit Testing Laboratory, Detroit.

Testing Machines.

Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Thread Cutting Tools
Hart Manufacturing Co., Cleveland, Ohio

Tiling, Opal Glass.
Toronto Plate Glass Importing Co., Toronto.

Time Switches, Automatic, Electric.
Berlin Electric Mfg. Co., Toronto.

Tinware Machinery
Canada Machinery Agency Montreal.

Tire Upsetters or Shrinkers
Canadian Buffalo Forge Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.

Tool Cutting Machinery
Canadian Rand Drill Co., Montreal.

Tool Holders.
Armstrong Bros. Tool Co., Chicago.
Baxter Paterson & Co., Montreal.
John Millen & Son, Ltd, Montreal
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.

Tool Steel.
Wm. Abbott, Montreal.
Wm. Jessop, Sons & Co., Toronto.
Canadian Fairbanks Co., Montreal
B. K. Morton & Co., Sheffield, Eng.
Williams & Wilson, Montral.

Torches, Steel.
Baxter, Paterson & Co, Montreal.
Dominion Foundry Supply Co., Montreal
Hamilton Facing Mill Co., Hamilton.

Transformers and Convertors
Allis-Chalmers-Bullock, Montreal.
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
Hall Engineering Works, Montreal, Que.
T. & H. Electric Co., Hamilton.

Transmission Machinery
Allis-Chalmers-Bullock, Montreal.
The Canadian Fairbanks Co., Montreal.
The Dodge Mfg. Co., Toronto.
Laurie Engine & Machine Co., Montreal.
Link-Belt Co., Philadelphia.
Miller Bros. & Toms Montreal.
H.W. Petrie, Toronto.
The Smart-Turner Mach. Co., Hamilton.
Waterous Engine Co., Brantford.

Transmission Supplies
Baxter, Paterson & Co., Montreal.
The Canadian Fairbanks Co., Montreal.
The Dodge Mfg. Co., Toronto.
The Goldie & McCulloch Co., Galt.
Miller Bros. & Toms Montreal
Pendrith Machinery Co, Toronto.
H. W. Petrie, Toronto.

Trolleys
Canadian Rand Drill Co., Montreal.
John Millen & Son, Ltd., Montreal.
Miller Bros. & Toms, Montreal.

Trucks, Dryer and Factory
Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon's Limited, Galt, Ont.

Tube Expanders (Rollers)
Chicago Pneumatic Tool Co., Chicago.
A. B. Jardine & Co, Hespeler.

Turbines, Steam
Allis-Chalmers-Bullock Limited, Montreal
Canadian General Electric Co., Toronto.
Canadian Westinghouse Co., Hamilton.
D'Olier Engineering Co., New York.
Jenckes Machine Co., Sherbrooke, Que.
Kerr Turoine Co., Wellsville, N.Y.

Turntables
Dominion Foundry Supply Co., Montreal

Turret Machines.
American Tool Works Co., Cincinnati.
John Bertram & Sons Co., Dundas, Ont.
The Canadian Fairbanks Co., Montreal.
London Mach. Tool Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Hartford, Conn.
The Stevens Co., Galt, Ont.
Warner & Swasey Co., Cleveland, Ohio.
Williams & Wilson, Montreal.

Upsetting and Bending Machinery.
John Bertram & Sons Co., Dundas, Ont
A. B. Jardine & Co., Hespeler.
London Mach. Tool Co., Hamilton, Ont.
National Machinery Co., Tiffin, O.
Niles-Bement-Pond Co., New York.

Valves, Blow-off.
Chicago Pneumatic Tool Co., Chicago.

Valves, Back Pressure.
McEachren Heating and Ventilating Co., Galt, Ont.
Sheldon & Sheldon, Galt.

Valves, Reducing.
McEachren Heating and Ventilating Co., Galt, Ont.
Engineering Specialties, Belfast, Ireland

Vaults.
The Goldie & McCulloch Co., Galt.

Ventilating Apparatus.
Canada Machinery Agency, Montreal
Canadian Buffalo Forge Co., Montreal.
McEachren Heating and Ventilating Co., Galt, Ont
Sheldon & Sheldon, Galt, Ont.
B. F. Sturtevant Co., Hyde Park, Mass.

Vises.
Baxter, Paterson & Co., Montreal.
Butterfield & Co., Rock Island, Que.
Rice Lewis & Son, Toronto
John Millen & Son, Ltd., Montreal.
Miller Bros & Toms, Montreal.
The Stevens Co., Galt, Ont.

Vises, Planer and Shaper.
American Tool Works Co., Cincinnati, O.
A. B. Jardine & Co., Hespeler, Ont.
John Millen & Son, Ltd., Montreal.
Niles-Bement-Pond Co., New York.
The Stevens Co., Galt, Ont.

Washer Machines.
National Machinery Co., Tiffin, Ohio.

Water Power Plants.
Jenckes Machine Co., Sherbrooke, Que.

Water Wheels.
Allis-Chalmers-Bullock Co., Montreal.
The Goldie & McCulloch Co., Galt, Ont.
Canada Machinery Agency, Montreal.
Jenckes Machine Co., Sherbrooke, Que.

Wheelbarrows.
Baxter, Paterson & Co., Montreal.
Buffalo Foundry Supply Co Buffalo
Dominion Foundry Supply Co, Montreal

Winches, Hand.
Pendrith Machinery Co., Toronto.

Window Wire Guards.
Expanded Metal and Fireproofing Co. Toronto.
B. Greening Wire Co., Hamilton, Ont.

Wire Chains.
The B. Greening Wire Co., Hamilton.

Wire Cloth and Perforated Metals.
Expanded Metal and Fireproofing Co. Toronto.
B. Greening Wire Co., Hamilton. Ont.

Wire Guards and Railings.
Expanded Metal and Fireproofing Co. Toronto.
B. Greening Wire Co. Hamilton, Ont.

Wire Nail Machinery.
National Machinery Co., Tiffin, Ohio.

Wire Rope.
B. Greening Wire Co, Hamilton, Ont.

Wood-working Machinery.
Baxter, Paterson & Co., Moutreal
Canada Machinery Agency, Montreal.
The Canadian Fairbanks Co., Montreal.
Clark-Demill Co., Hespeler, Ont.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
St. Lawrence Supply Co., Montreal.
Waterous Engine Works Co., Brantford.
Williams & Wilson, Montreal.

Wrenches, Adjustable Tap.
Baxter, Paterson & Co., Montreal.
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Hespeler Ont.
Standard Tool Co., Cleveland.

Wrenches, Machinists.'
Baxter, Paterson & Co. Montreal.
Whitman & Barnes Co., St. Catharines.

Wrenches, Ratchet.
Whitman & Barnes Co., St. Catharines

Wrenches, Universal.
Whitman & Barnes Co., St. Catharines

Wrought Iron and Steel Washers.
Baxter, Paterson & Co, Montreal.

ALPHABETICAL INDEX.

A

Abbott, Wm. ... 66
Allis-Chalmers-Bullock Co. ... Outside back cover
American Tool Works Co ... 5
Armstrong Bros. Tool Co ... 78

B

Barnes, T. W. ... 71
Barnes, B. F., Co. ... 3
Banfield, W. H., & Sons ... 73
Baxter, Paterson & Co. ... 10
Becker-Brainard Milling Machine Co. ... 2
Berlin Electrical Mfg. Co ... 18
Bertram, John, & Sons ... front cover
Bickford Drill & Tool Co. ... 5
Bliss, E. W., Co ... 4
Brandeis, Charles ... 67
Brown & Sharpe Mfg. Co. ... 76
Budden, Hanbury A. ... 67
Buffalo Foundry Supply Co. ... 70
Butterfield & Co. ... 79

C

Canada Forge Co ... 18
Canada Machinery Agency ... 15
Canada Metal Co ... 15
Canadian Pneumatic Tool Co ... 76
Canada Chemical Mfg. Co ... 15
Canadian Buffalo Forge Co ... 8
Canadian Fairbanks Co ... 20
Canadian General Electric Co. ... 78
Canadian McVicker Engine Co ... 66
Canadian Rand Drill Co. ... 75
Canadian Westinghouse Co ... 1
Carr, John ... 72
Chadwick Bros ... 71
Clark-Demill Co ... 10
Cleveland Automatic Mach. Co ... 9

D

DeCew, J. A ... 67
Detroit Testing Laboratory ... 67
De Clercy, Jules ... 67
Diamond Saw and Stamping Works ... 73
Dillou A., & Son ... 72
Dodge Mfg. Co ...
Dods P. D. & Co ... 68
Dominion Foundry Supply Co ... 70
Dominion Henderson Bearings ... 13
D'Olier Engineering Co ... 15
Dominion Belting Co. ... 71

E

Economical Mfg. and Supply Co ... 16
Economic Power, Light and Heat Supply Co ... 65
Electric Blue Print Co ... 67
"Electrical Times" ... 72
"Engineering" ... inside back cover
Engineering Specialties Co ... 57
"Engineering Times" ... 72
Expanded Metal and Fireproofing Co. 66

F

Fetherstonhaugh & Co. ... 67
Fetherstonhaugh & Blackmore ... 67
Fielding, John S. ... 67

G

Gibb, Alex ... 71
Geometric Tool Co ... 78
Globe Machine & Stamping Co ... 71
Goldie & McCulloch Co ... 1
Greening, B., Wire Co ... 74

H

Hall Engineering Works ... 9
Hamilton Facing Mills Co ... 71
Hamilton Pattern Works ... 72
Hanna Engineering Works ... 75
Hart Mfg Co ... 73
Howard, Geo. H. ... 9

J

Jardine, A. B., & Co ... 73
Jenckes Machine Co. ... 12
Jessop, Wm., & Sons ...

K

Kay Electric Dynamo & Motor Co. ... 68
Ker & Goodwin ... 73
Kerr Turbine Co. ... 69

L

Laurie Engine and Machine Co. ... 16
Leona d, E., & Sons ... 18
Lewis, Rice, & Son ... 80
Link-Belt Co. ... 14
London Machine Tool Co ... 6, 7

M

Manitoba Iron Works ... 12
McDougall, R., Co ... 4
McDougall, John, Caledonian Iron Wks 18
McEachern Heating & Ventilating Co. 9
McLaren, J. C., Belting Co. ... 57
McLean, W. B. & Co. ... 16
Marion & Marion ... 67
Merrell Mfg. Co. ... 4
Millen, John, & Son ... 2
Miller Bros. & Toms ... 18
Morrow, John, Machine Screw Co. ... 72
Morse Twist Drill and Machine Co. ... 79
Morton, B. K. & Co. ... 74

N

National Machinery Co ... 67
Niagara Falls Machine & Foundry Co. 69
Nicholson File Co. ... 74

O

Osborn Mfg. Co ... 71
Otis-Fensom Elevator Co. inside back cover

P

Pacific Coast Pipe Co., Vancouver, B.C. 14
Packard Electric Co. ... inside back cover
Parke, Roderick J. ... 67
Paxton, J. W. Co ... 70
Penberthy Injector Co ... 66
Pendrith Mach. Co ... 72
Petrie, H. W ... 11
Plews & Trimingham ... 67
Potter & Johnston Machine Co ... 9
Pratt & Whitney Co. ... inside front cover
Pringle, T., & Son ... 67

R

Remington Typewriter Co ... 67
Ridout & Maybee ... 67
Robb Engineering Co ... 13
Royce, James C. ... 67

S

Sheldons Limited ... 8
Smart-Turner Machine Co ... 65
Standard Tool Co ... 79
Starrett, L. S., Co ... 77
Stevens Co. of Galt ... 3
St. Lawrence Supply Co ... 65
Sturtevant, B. F., Co ... 7
Sylvester Mfg. Co ... 66

T

Technical Pub. Co ... 80
Toronto and Hamilton Electric Co ... 72
Toronto Plate Glass Importing Co ... 73

U

Union Drawn Steel Co ... 2

V

Volta Electric Repair Works ... 75

W

Warner & Swasey Co ... 3
Waterous Engine Works Co ... 12
West Haven Mfg. Co ... 74
Wells Pattern & Model Works ... 72
Williams & Wilson ... 17
Whitman & Barnes ... 77

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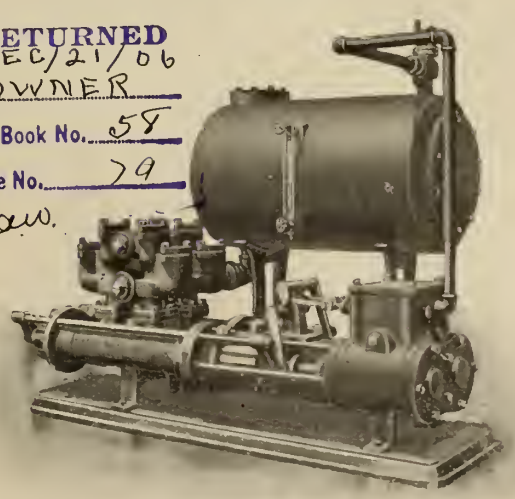

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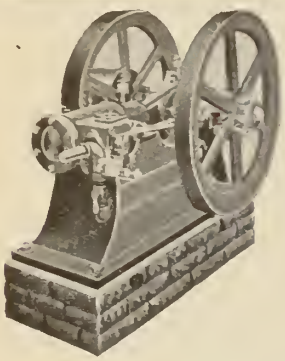

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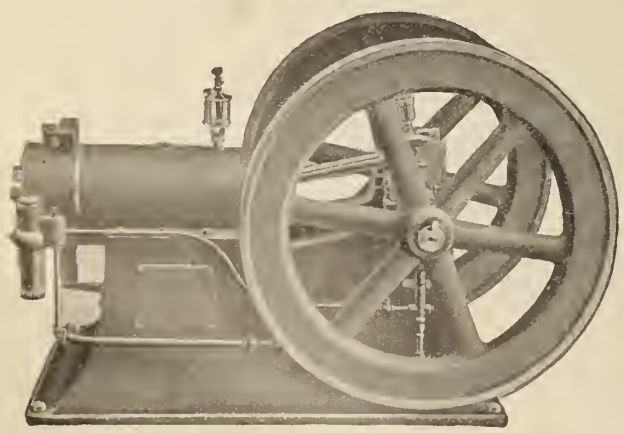

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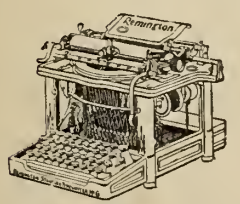

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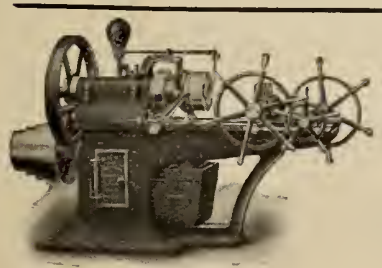

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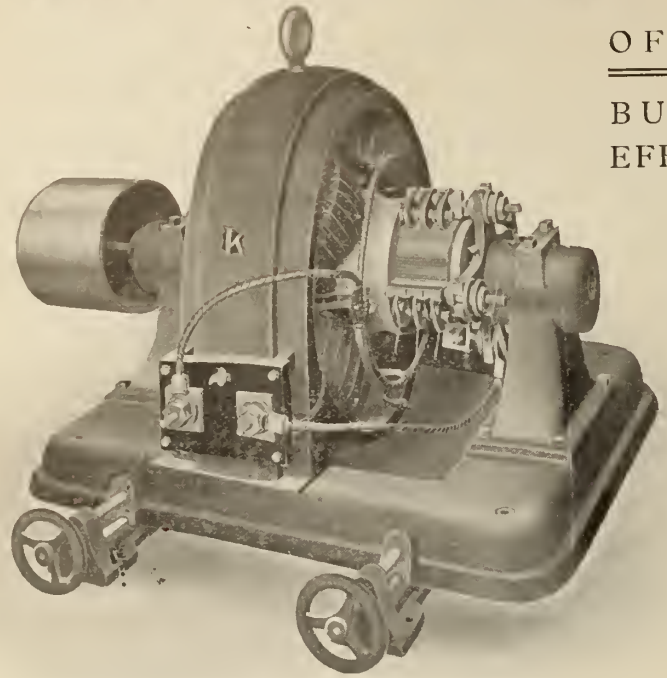

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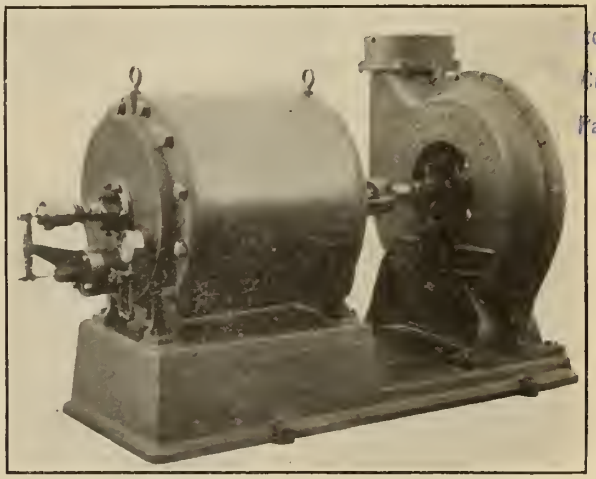

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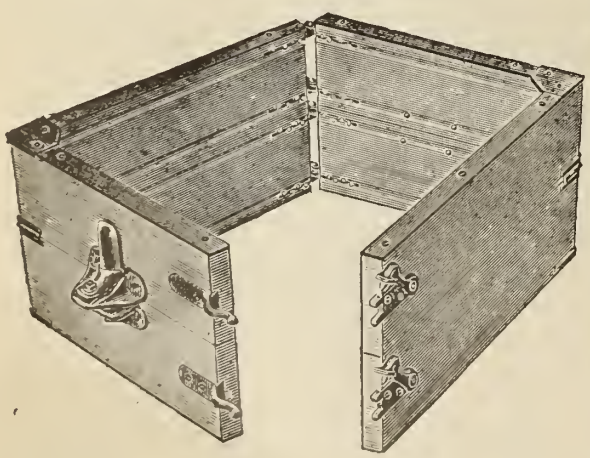

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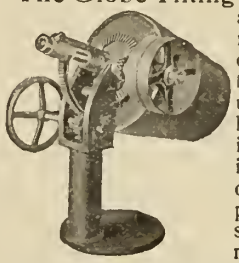

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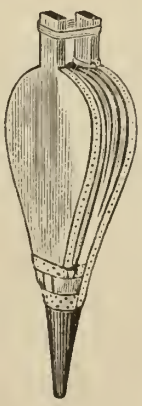

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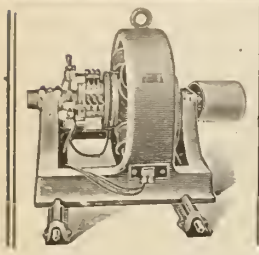

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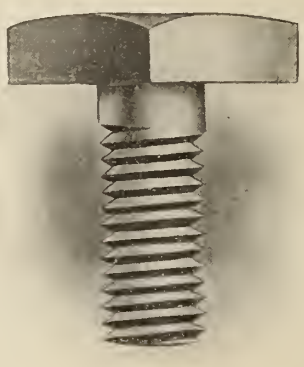

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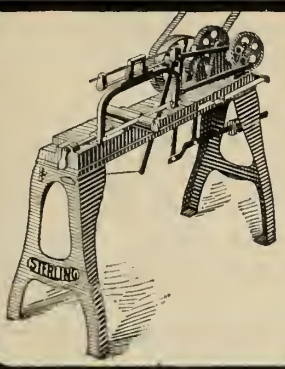

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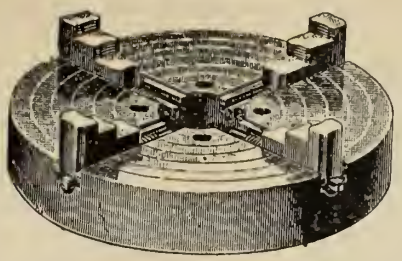

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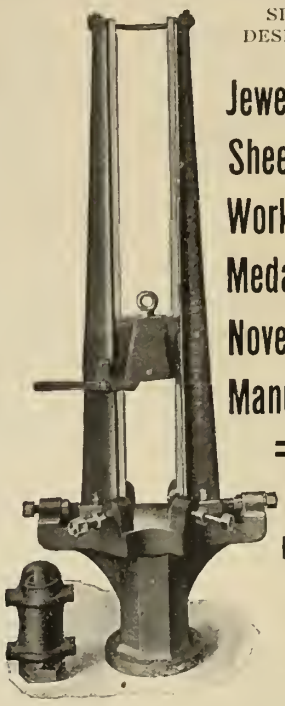

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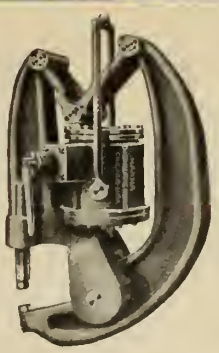

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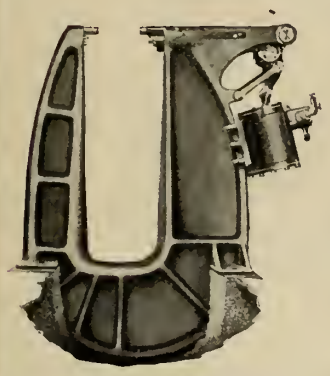
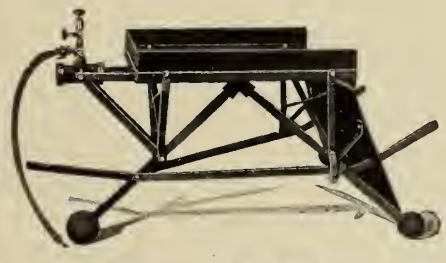

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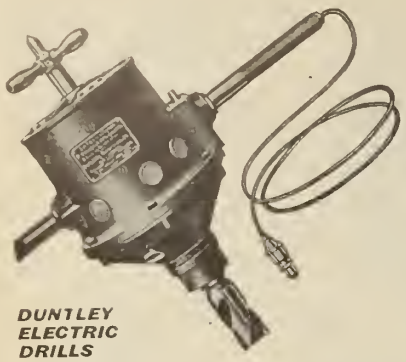

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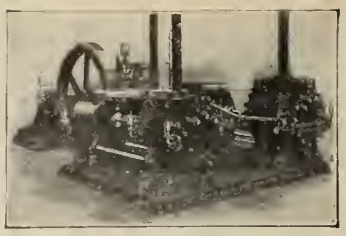

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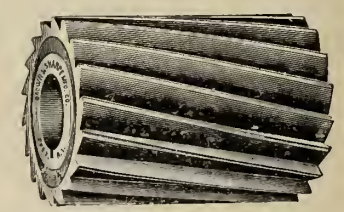

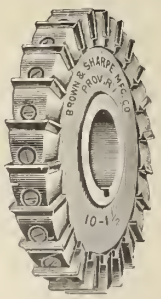

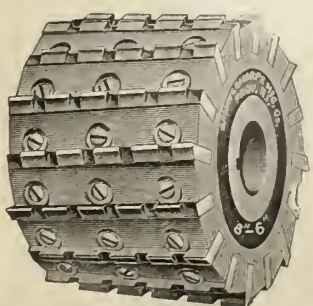

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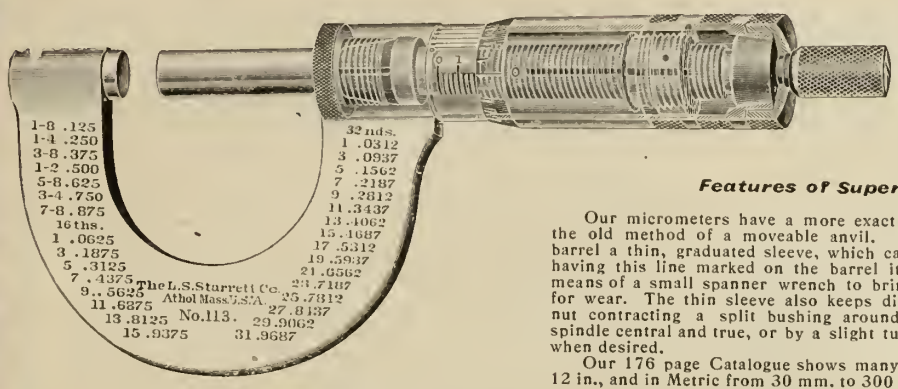

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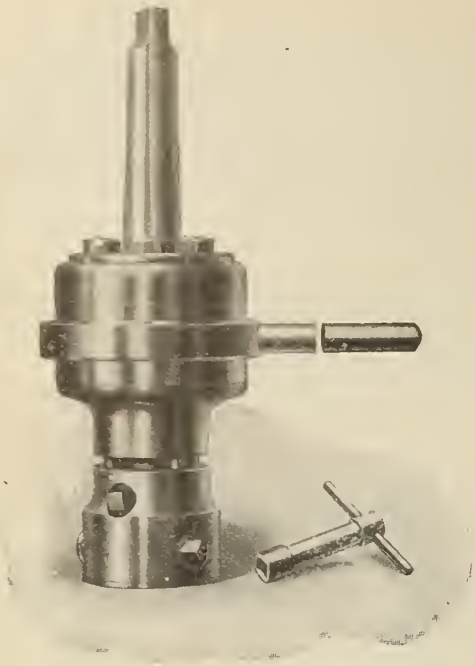

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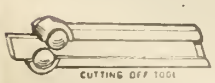

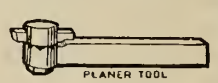

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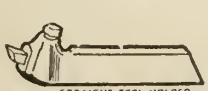

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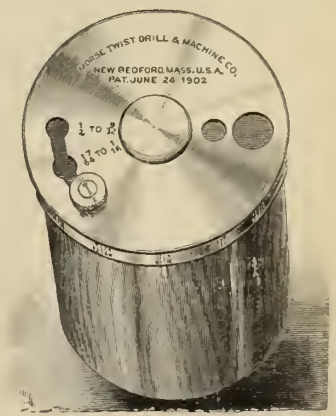

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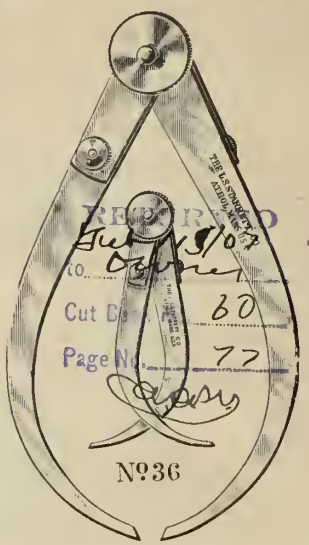

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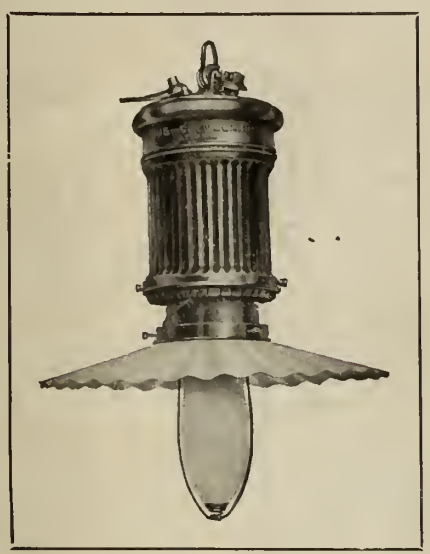

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